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"What Broker Charges Reveal about Mortgage Credit Risk"

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What Broker Charges Reveal about Mortgage Credit Risk*

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Abstract

Prior to the subprime crisis, mortgage brokers charged higher fees for loans that turned out to be riskier ex post, even when conditioning on other risk characteristics. We argue that, all else the same, high broker fees reveal borrower attributes that predict higher borrower risk, such as suboptimal shopping behavior, high valuation for the loan or high borrower-specific broker costs. Lenders observe these borrower attributes only indirectly through the fees. We show that fee-based mortgage pricing is unlikely to yield higher rates for loans with unobserved borrower risk. Our work contributes to the discussion of credit risk retention requirements for residential mortgages and the proposed QRM exemption criteria.

JEL Classifications: G12, G18, G21, G32

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1. Introduction

In response to the 2007-8 subprime crisis, Congress enacted credit risk retention requirements as part of the Dodd-Frank Wall Street Reform and Consumer Protection Act. The requirements mandate securitizers of mortgage-backed securities to retain an economic interest of at least 5% of the aggregate credit risk of non-government-backed loans collateralizing such securities, with exceptions made for so-called Qualified Residential Mortgages (QRMs). Many observers predict that the risk retention requirements will cause non-QRM loans to become significantly more costly for borrowers or not be available at all (Freedman (2011), Zandi and deRitis (2011)). The QRM term is to be defined jointly by six government agencies, which published a proposal of QRM guidelines in March 2011.[1] The stated goal is to ensure that QRM loans have "low credit risk even in stressful economic environments" (Agencies (2011)). One of the proposed restrictions stipulates that mortgage origination charges paid by the borrower cannot exceed 3% of the loan amount.

While limits on origination charges have historically been imposed to fight predatory lending (HUD (2000)), the interplay between loan originator compensation and loan performance is less understood.[2] Our paper fills this gap. We establish that higher origination charges are indeed associated with higher mortgage credit risk. Our data include all mortgage-broker-originated loans funded by formerly one of the largest subprime lenders, New Century Financial Corporation, between 1996 and 2006. Mortgage brokers originated over 70% of New Century's loans. For each loan we observe detailed origination and servicing records. Loan-level data on broker revenues provide a tight lower bound on origination charges. Figure 1 shows a dramatic increase in average 12-month delinquency rates as percentage broker revenues increase, from about 10% for loans with revenues of 1-2% of the loan amount to over 19% for those with revenues of more than 5%.

[Figure 1 about here]

The link between percentage broker revenues and mortgage credit risk may arise because revenues proxy for known risk characteristics. For example, as long as there are fixed costs associated with originating a loan, percentage revenues are likely to be larger for smaller loans. In our data, average percentage revenues decline steadily as the loan size increases. At the same time, small loans

[1] The six agencies are the Office of the Comptroller of the Currency, the Federal Reserve Board, the Federal Deposit Insurance Corporation, the Securities and Exchange Commission, the Department of Housing and Urban Development and the Federal Housing Finance Agency.

[2] Most recent studies, such as Demyanyk and Hemert (2011) and Jiang, Nelson, and Vytlacil (2011), relate delinquency risk to loan, property and borrower characteristics but, due to a lack of data, do not control for loan originator compensation. An exception is Garmaise (2009) who takes an in-depth look at broker-lender relationships for prime loans. The median borrower in his sample, however, does not pay any direct broker fees, thereby making it difficult to establish a link between such charges and mortgage credit risk.

are generally the riskier ones. Small loans are often taken out by low-income borrowers purchasing or refinancing homes in neighborhoods with a high percentage of minorities and a low percentage of college graduates. Therefore, small loan size—and hence high percentage revenues—serve as strong unconditional indicators of high delinquency risk.

While variables such as the loan amount predict broker revenues, we find substantial heterogeneity in revenues even after controlling for observable loan, property, borrower and broker characteristics. "Observable" refers to data observed by the lender and the econometrician, and excludes information available only to the borrower and the broker. A main contribution of our paper is to provide comprehensive evidence that conditional broker revenues reflect unobserved heterogeneity in mortgage credit risk. Using a proportional odds duration model for the probability of first-time delinquency, we find that a marginal increase in broker revenues by 1% of the loan amount is associated with a 6.4% higher odds ratio.

The mortgage brokers in our sample operate as independent service providers who match borrowers with lenders. They are compensated by charging a direct fee to the borrower and by earning so-called yield spread premia from the lender. The marginal predictive power of broker revenues for future delinquency risk stems, almost exclusively, from the fee component. Less than 40% of the variation in percentage fees are explained by observable loan, property, borrower and broker characteristics, and the yield spread premia. In addition to being widely dispersed, residual fees are skewed to the right, indicating that a sizable fraction of borrowers paid high conditional fees.

We use a simple model of bargaining between the borrower and broker where the broker learns the borrower's reservation value for the fees and has all the bargaining power. Borrowers shop from one or more brokers according to a second-price auction process (Woodward and Hall (2012)). We argue that, all else the same, brokers extract higher fees from borrowers that shop from fewer brokers, especially borrowers with a high valuation for the loan that shop from only one broker, or borrowers for which broker costs are perceived to be higher. Broker costs are the costs that the broker expects to incur between the time she strikes a deal with the borrower and the closing date.

Given a set of observable characteristics, a marginal increase in broker fees by 1% is associated with a 7.6% higher odds ratio of first-time delinquency. Our findings suggest that borrower attributes such as shopping behavior, valuation for the loan or borrower-specific broker costs not only impact the fees the broker charges the borrower but also predict mortgage credit risk, even when conditioning on other risk characteristics. The broker observes these attributes but does not disclose them to the lender or econometrician, although the lender may choose to exert additional efforts to screen applicants for soft information. We interact fees with borrower credit scores and

find that conditional fees reveal more unobserved borrower risk for high-FICO loans, which is consistent with lenders screening high-FICO loans less carefully (Bubb and Kaufman (2009), Keys, Mukherjee, Seru, and Vig (2010)).

Having established that higher broker revenues reflect higher delinquency risk, both conditionally and unconditionally, we address the question of whether this link can be used in practice to differentiate riskier from safer loans. The answer is not as straightforward as one might expect. Consider two borrowers that apply for the same 100K mortgage through the same broker and provide identical information on their respective loan applications. Suppose that the broker's cost for intermediating the loan is 3K for either borrower. The first borrower shops around for the best deal and his reservation value for the fees is 3K. The second borrower does not shop from any other brokers and is confused about the terms of the loan, resulting in a higher reservation value of 4.5K. Our empirical evidence is consistent with the second borrower being riskier than the first, even though the observable characteristics are the same for both borrowers.

If there are no feedback effects from fees to mortgage pricing, our model implies that the fees for the first and second borrower are set at 3K and 4.5K, respectively. If, however, as a result of the QRM requirements interest rates were to increase significantly for loans with fees in excess of 3K, the second borrower may no longer be able or willing to pay 4.5K in fees. Since the broker is paid only if the loan closes, she in turn may be willing to give up 1.5K in revenue and offer the second borrower the lower-rate loan for a fee of 3K. The fee-based rate schedule may prevent the broker from pocketing all gains from trade with the second borrower. But differential pricing of riskier versus safer loans may not be achieved as both mortgages may still be originated at the same rate.

The proposed limit on origination charges necessarily precludes only those loans from QRM status for which the broker's cost of originating the mortgage exceeds the maximum permissible charge. The fee-based rate schedule implied by the QRM requirements is meaningful only if, all else the same, brokers perceive costs to be higher for riskier borrowers. If brokers perceive costs to be the same for loans with the same observable characteristics, loans with unobserved borrower risk could still be originated as QRM loans. Suppose that costs are 3K per loan, no matter what its size or type. Then both the first and the second borrower's loan could be originated in accordance with the 3% limit on origination charges. The 3% cap would act as a size rule that prevents borrowers that take out less than 100K from having access to low mortgage rates. Because smaller loans are generally the riskier ones, the credit risk among QRM loans would likely be lower.

Since the potential impact of the proposed 3% limit on origination charges is closely tied to the cost of broker services, and since neither the lender nor the econometrician can observe these

costs directly, we consider a range of cost estimates spanned by two polar cases. In the first case, the perfect rent extraction case, the broker's cost is set equal to the minimum revenue observed for loans with the same observable characteristics. As long as some loans are originated at cost, the perfect rent extraction case is consistent with a scenario where borrowers shop from only one broker and there is no unobserved heterogeneity in costs. Average cost estimates are about 2.2K, and the average profit margin between revenues and costs amounts to 3.1K per loan. Estimated broker costs exceed 3% of the loan amount for only 2.5% of the loans in our sample. The proposed 3% limit acts as a size rule since virtually all of the loans that are precluded from QRM status because of the 3% cap are small loans of 100K or less. The average 12-month delinquency rate for loans with percentage costs higher than 3% is 24.7%, compared to 13.1% for all other loans.

In the second case, the perfect competition case, the broker's cost is set equal to the observed revenue. The perfect competition case is consistent with a scenario where borrowers shop from multiple brokers with the same cost. Suppose there are different types of brokers, such as high versus low volume brokers, rookie versus seasoned brokers or local versus national brokers. Suppose also that costs for a given borrower are the same across brokers of the same type, but not necessarily across brokers of different types. If borrowers observe broker types, have a preference for a certain type and shop from two or more brokers of that type, loans are intermediated at cost. Conditional on broker type, any unobserved heterogeneity in costs stems from heterogeneity across borrowers. For example, brokers may perceive time costs to be higher for borrowers who may need extra prodding or close supervision while preparing the loan documents.

For the perfect competition case, costs are estimated to be as high and as disperse as possible. More than 48% of the loans in our sample have costs in excess of 3% of the loan amount. The average 12-month delinquency rate for loans with costs greater than 3% is 16.0% compared to 11.0% for all other loans. Even for heterogeneous cost estimates, the fraction of small loans that is excluded from QRM status by the 3% cap is much larger than that of large loans. The average cost estimates are 4.7K for 100-200K loans, 6.7K for 200-300K loans and 8.6K for 300-500K loans. The level of the cost estimates seems rather high, and the increase in costs along the size spectrum seems rather steep, considering that to a large extent the only cost incurred is the value of the broker's time. Besides giving implausibly high cost estimates, the perfect competition assumption is also contradicted by Lacko and Pappalardo (2007) and the Federal Reserve Board (2008) who find that many borrowers shop from only one broker. This leads us to believe that many of the observed broker revenues do indeed reflect positive profit margins.

The perfect rent extraction case offers a lower and homogeneous bound for the conditional cost

estimates that we consider, whereas the perfect competition case provides an upper and heterogeneous bound. For a wide range of cost estimates within these two bounds, we show that the proposed 3% limit on origination charges reduces delinquency risk mainly by restricting access to mortgage credit for small loans. After conditioning on loan amount, the variation in costs is substantially smaller. Thus the proposed 3% cap is likely to be less effective in incentivizing mortgage brokers to reveal otherwise unobserved borrower risk.

If the goal is to protect lenders from unobserved borrower risk, we recommend that only a portion of the fees is paid to the broker at closing. The remaining fees are placed in a trust for a certain number of months or until the loan becomes delinquent, whichever occurs first. If the loan remains active throughout the waiting period, the accrued value of the remaining fees is paid to the broker, otherwise that amount goes to the lender. If the fee received at closing represents a benchmark conditional broker fee, our proposed strategy exploits the unobserved heterogeneity in fees to reduce the creditor's risk exposure, without imposing additional constraints on access to mortgage credit. For loans that are sold and securitized, it is in the interest of secondary market investors to incentivize lenders to disclose origination charges and to pass along any payouts from high conditional fees in the event of an early delinquency.[3]

While the stated goal of the proposed QRM definition is to identify low-credit-risk loans, limits on origination charges have historically been imposed to fight predatory lending. A 3% cap on origination charges reduces marginal broker profits—defined as the difference between revenues and costs—by as much as $700 per loan, depending on the cost estimates. The 3% limit does not, however, reduce the profit differential between large and small loans. Even with the 3% cap in place, brokers may benefit from steering borrowers towards larger loans or may expand extra efforts to attract large borrowers.

If the goal is to protect borrowers from paying high margins above costs, we recommend a concave rather than a linear limit on origination charges mainly because costs are a concave rather than linear function of loan size. We offer a roadmap for stress testing alternative QRM specifications and propose a concave ceiling that limits origination charges to 3% for loans smaller than 200K and to 10K for loans larger than 500K. The alternative specification is more effective than the 3% cap in protecting large borrowers from paying high margins above costs, without increasing delinquency risk or restricting access to mortgage credit relative to the current QRM proposal.

[3]Recent work on securitization and mortgage default include Mian and Sufi (2009), Keys, Mukherjee, Seru, and Vig (2010), Keys, Seru, and Vig (2010), Jiang, Nelson, and Vytlacil (2010), Bubb and Kaufman (2011), Bubb and Kaufman (2009), Elul (2011), Hartman-Glaser, Piskorski, and Tchistyi (2011), and the references cited therein.

2. The Mortgage Origination Process

We develop a model of the mortgage origination process to understand what origination charges may reveal about mortgage credit risk. We focus on loans originated in the wholesale market, where independent mortgage brokers act as financial intermediaries matching borrowers with lenders. They assist borrowers in the selection of the loan and in completing the loan application, and provide services to wholesale lenders by generating business and helping them complete the paperwork.

Consider a borrower that arrives at a broker requesting a mortgage.[4] The broker evaluates the borrower's and the property's characteristics, and based on that information provides the borrower with one or more financing options. A financing option consists of a specification of the loan terms such as the loan amount, type of loan and level of income documentation, and of the associated mortgage rate. It also outlines the fees the broker will charge the borrower. To compile such a list of financing options, the broker reviews wholesale rate sheets distributed by potential lenders. These rate sheets state the minimum rate as a function of loan, borrower and property characteristics at which a given lender is willing to finance a loan. We refer to this rate as the lender's base rate. Until recently, rate sheets also informed the broker about the yield spread premium (YSP) that the lender pays to the broker for originating the loan at a rate higher than the base rate. The borrower and the broker bargain over the terms of the loan, the rate and the fees. Once they reach an agreement, the broker submits a funding request to one or more lenders. The lender reviews the application material and responds with a decision to fund the loan or not. If the loan is funded, the broker receives the fees and YSP at the time of closing.

We explore the view that a lender will fund the loan as long as the broker collects and transfers the requested application materials and secures a rate at or above the lender's base rate. Since the broker is paid only if the loan is made, she will only offer fundable proposals to the borrower and ensure that the application materials are presented to the lender in a timely fashion. Let L denote the vector summarizing the terms of the loan including the loan type, the loan amount, the loan maturity, the documentation level, and any prepayment penalties. The initial mortgage rate r has to be at or above the base rate of the lender to whom the loan application is submitted. We use f to denote the fee that the broker charges the borrower for originating the loan. Each vector (L, r, f) represents a financing option, and the borrower and broker have to agree on L, r and f.

The net benefit the borrower derives from her contact with the broker is $\overline{f} - f$, where $\overline{f}$ denotes

[4]The borrower is matched with the broker either by chance, following a recommendation of a real estate broker or someone else, or as a result of marketing efforts by the broker. We do not model borrower-broker interactions prior to the time that a deal is made.

the borrower's reservation value for the fees and is given by

$$\overline{f} \;=\; \nu - o.$$

Here, ν is defined as the borrower's dollar valuation for the loan (L, r) and o is the dollar value of the borrower's outside options, as perceived by the borrower at the time the deal is made. We use y to denote the yield spread paid by the lender, and c for the broker's cost of originating the loan. Broker costs are the costs the broker expects to incur between the time she strikes a deal with the borrower and the time the loan closes. They include the broker's time costs of dealing with the borrower as well as any administrative costs paid by the broker for intermediating the mortgage. The broker's reservation value for the fees, $\underline{f}$, is equal to her cost minus any YSP received,

$$\underline{f} \;=\; c - y. \tag{1}$$

The broker's net surplus from originating the loan is $f - \underline{f}$, and the borrower's and broker's joint surplus is the sum of their respective benefits,

$$\overline{f} - \underline{f} \;=\; \nu - o + y - c. \tag{2}$$

We consider a simple model of bargaining between the borrower and broker where the broker learns the borrower's reservation value $\overline{f}$ and has all the bargaining power. The broker maximizes her net surplus $f + y - c$ by choosing the lender and (L, r, f), subject to the borrower's participation constraint, $f \leq \nu - o$, and the broker's participation constraint, $f \geq c - y$.

For the remainder of this section, we assume that fees f can be set without a feedback effect on other terms of the loan. We note that throughout our sample period, the Home Ownership and Equity Protection Act of 1994 (HOEPA) imposed a number of restrictions on loan features for certain mortgages, including those with very high fees. High-fee loans were defined as loans for which total origination charges exceed the larger of $592 or 8% of the loan amount.[5] Because the ceiling on origination charges was set rather high, it was binding only for a small fraction of loans.

[5]The $592 figure is for 2011. The amount is adjusted annually by the Federal Reserve Board, based on changes in the Consumer Price Index. For details see www.ftc.gov/bcp/edu/pubs/consumer/homes/ rea19.shtm. The rules for loans are listed in Section 32 of the Federal Reserve Board's Regulation Z. "Section 32 mortgages" are banned from balloon payments, negative amortization, and most prepayment penalties, among other features.

2.1. Setting fees when there is no feedback to loan terms

As long as the fees f can be set without impacting other terms of the loan, the broker sets the fee equal to the borrower's reservation value, that is $f = \overline{f}$ or

$$f \quad = \quad \nu - o. \tag{3}$$

Equations (1) and (3) allow us to write the broker's net surplus as $\nu - o + y - c$. In other words, the broker captures all of the joint gains from trade in Equation (2). The terms of the loan and interest rate are set so as to maximize those gains from trade, provided that the broker's revenues cover the costs, $f + y \geq c$. The broker's total revenues are given by

$$f + y \quad = \quad c + (\nu - o + y - c). \tag{4}$$

The revenues are equal to the cost of intermediating the loan plus the surplus that the broker is able to capture. We refer to the surplus captured by the broker, $\nu - o + y - c$, as marginal broker profits. These marginal profits do not immediately inform about potential profits a new entrant to the mortgage broker business may obtain as they do not control for the costs of identifying and attracting prospective borrowers.

2.2. Borrower shopping behavior

The borrower's shopping behavior determines the value of his outside options, o, and therefore the broker fees. Similar to Woodward and Hall (2012), we assume a second-price auction process where the borrower seeks initial quotes from multiple brokers and uses these quotes to extract better proposals until the process ends with one quote that no other broker is willing to beat. Let K denote the number of brokers the borrower shops from whose reservation value for the fees is no higher than the borrower's net surplus from obtaining the mortgage. If $K = 1$, the outside option is no mortgage and $o = o(\text{no mortgage})$ is the value of not receiving the mortgage. The broker can extract the entire net surplus from purchasing the house or refinancing the loan. If $K \geq 2$, the observed revenue is the cost of the second-lowest-cost broker. The originating broker extracts all of the surplus in the bargain with the borrower, whose outside option is to accept the runner-up bid.

In summary, the broker's revenues in Equation (4) are equal to

$$f + y \quad = \quad \begin{cases} \nu - o(\text{no mortgage}) + y, & \text{when } K = 1 \\ \text{cost of second-lowest-cost broker}, & \text{when } K \geq 2. \end{cases} \tag{5}$$

With a slight abuse of notation, we refer to $K = 1$ as the case where the borrower shops from only one broker, and to $K \geq 2$ as the case where the borrower shops from two or more brokers.

2.3. Unobserved heterogeneity in broker fees

When analyzing what broker charges may reveal about mortgage credit risk, it is important to understand how much of the variation in broker fees can be predicted from other observable characteristics and the yield spread premium, and how much of it is due to unobserved heterogeneity in fees. We take the view that the broker's information set, as it pertains to a mortgage transaction, includes the borrower's information set. The econometrician, meaning us or another third party, observes the information provided on the loan application that includes broker fees and is a subset of the borrower's information set. The econometrician also observes certain broker characteristics and the yield spread premia paid by the lender which the borrower may or may not observe. The lender's information set is the same as the econometrician's, unless the lender exerts additional efforts to screen applicants for soft information. We refer to "observable" data as the data observed by the econometrician, but usually exclude broker fees and YSP. Below we discuss sources of unobserved heterogeneity in fees, assuming that f is set as in Equation (5).

We first consider a borrower that shops from only one broker. In this case, $f = \nu - o(\text{no mortgage})$, where $o(\text{no mortgage})$ measures the borrower's perceived net benefits from staying in his current house or rental or, for a mortgage refinance, from keeping the same mortgage terms. The borrower's valuation of a loan, ν, measures the wealth equivalent benefits that the borrower expects to receive from the loan. It is given by

$$\nu \quad = \quad H - V,$$

where H denotes the dollar value of the benefits the borrower expects to draw from owning the home, and V is the expected present discounted value of current and future mortgage payments. H can be higher than the appraisal value or the actual purchase price for the house if the borrower derives extra utility from the home, perhaps because it is located in a particular neighborhood, is of a particular size, or is close to work or certain services. Under such circumstances, the borrower may be willing to pay a higher than average fee, but is not necessarily more likely to become delinquent. Alternatively, if the borrower is overly optimistic about the resale value of the home, and as a result consumes above his means, then an abnormally high value of H may indeed reflect increased mortgage risk.

Unobserved heterogeneity in fees may also stem from unexplained variation in V. We measure

time in months and use T to denote the maturity of the loan, T_P the time at which the borrower prepays the loan in full, and T_D the time of mortgage default. Assuming that the borrower is risk-neutral, V is given as

$$\begin{aligned} V &= E\left\{\sum_{m=1}^{\min\{T,T_P,T_D\}-1} \delta_m\, p_m + \delta_T\, p_T\, 1_{\{T\leq\min\{T_P,T_D\}\}}\right\} \\ &\quad + E\left\{\delta_{T_P}\left(p_{T_P}+B_{T_P}\right) 1_{\{T_P<\min\{T,T_D\}\}} + \delta_{T_D}\, F_{T_D}\, 1_{\{T_D\leq\min\{T,T_P\}\}}\right\}, \end{aligned} \tag{6}$$

where δ_m is the borrower-specific discount factor for spending or receiving one dollar m months from now and $1_{\{.\}}$ denotes the indicator function. The mortgage is terminated early if either prepayment or default occurs prior to the original maturity date. The payments made in month m are denoted by p_m. They include the principal and interest payments due after m months, and may also include any additional down payments on principal that the borrower plans to make. p_0 are net payments due at closing, in addition to the fees charged by the broker. They include the downpayment for the loan and lender discount points. For a refinance loan, the amount of cash taken out, if any, would be subtracted. If the loan is paid off early after m months, B_m denotes the outstanding balance on the mortgage at that time. If the current loan is refinanced after m months, then B_m measures the time-m value of the payments associated with the new mortgage, including any fees to obtain the refinance mortgage minus the cash taken out. F_m is the costs the borrower incurs from becoming delinquent, other than having to give up the house. Expectations are taken with regard to the joint probability distribution of $\{\delta_m\}, \{p_m\}$, B_{T_P}, F_{T_D}, T_P and T_D.

Given a set of observable characteristics, V could be abnormally low if the borrower underestimates future payments $\{p_m\}$. This is conceivable for hybrid mortgages with adjustable rates or complex mortgages with negative amortization, where the actual distribution of potential future interest payments is wide and skewed to the right. Alternatively, the borrower may assign a higher than average probability to an early default time T_D, or expect the costs incurred from becoming delinquent, F_{T_D}, to be relatively low. Or he may underestimate the payments B_{T_P} associated with refinancing the loan at a later date.

In addition, the borrower could have negative information about his future financial situation that is not disclosed on the loan application, such as the knowledge that a household member is likely to loose or quit his job in the near future. As a result, the borrower's personal discount factors $\{\delta_m\}$ may be abnormally high for future periods m, resulting in high values of ν as long as there are positive net benefits from owning the home in future months. Brokers that observe negative private

borrower information may also be better able to discourage borrowers from shopping around.

If the borrower shops from more than one broker, observed revenues equal the costs of the second-lowest-cost broker. Given a set of observed characteristics that includes the yield spread premium, the only source of unobserved heterogeneity in broker fees is unexplained variation in costs. All else the same, brokers may perceive costs to be higher for borrowers that need extra prodding or close supervision while preparing the loan documents.

Independent of the borrower's shopping strategy, many of the reasons for high conditional broker fees are consistent with borrowers being less informed when compared to the average borrower, and more risky relative to the information provided on the loan application. This suggests that, all else the same, borrowers pay higher fees for loans that turn out to be riskier ex post. In what follows, we investigate whether the data support this hypothesis.

3. The New Century Loan Pool

Our empirical analysis is based on data obtained from IPRecovery, Inc. The dataset contains detailed records of all loans originated by New Century Financial Corporation. New Century made its first loan to a borrower in Los Angeles in 1996 and subsequently grew into one of the top three U.S. subprime lenders. It originated, retained, sold and serviced residential mortgages designed for subprime borrowers. An increase in early delinquencies in late 2006 and early 2007, together with inadequate reserves for such losses, led to New Century' s bankruptcy filing on April 2, 2007.

New Century's origination volume grew from less than 1 billion in 1997 to almost 60 billion in 2006. The explosive growth in volume was largely fueled by independent mortgage broker activity. Between 1997 and 2006, over 70% of all New Century loans were originated through the broker channel. This is consistent with the pattern observed for the broader subprime market, where prior to the subprime crisis mortgage brokers had become the predominant channel for loan origination. For example, as of 2005 mortgage brokers originated about 71% of all subprime loans.[6] Focusing on broker-originated loans allows us to abstract from differences in the compensation of brokers and loan officers, while still capturing the vast majority of New Century's business. Table 1 defines the variables used in our empirical analysis. Appendix A offers a detailed description of New Century's origination and servicing data and describes the steps we take to clean the raw data. In what follows, we compare New Century's origination activity to that of other subprime lenders.

[Table 1 about here]

[6]Detailed information is available at the Mortgage Bankers Association website www.mortgagebankers.org.

3.1. Origination data and loan performance

Table 2 reports descriptive statistics for the broker-originated loans funded by New Century between 1997 and 2006. We compare them to those reported in Demyanyk and Hemert (2011) for the First American CoreLogic LoanPerformance (LP) data. The LP data contain loan-level origination and servicing records for roughly 85% of all securitized subprime mortgages and offers the widest coverage of subprime loans available.[7] One drawback of the LP data is that they do not identify brokered loans nor report broker compensation. Nevertheless, we use the LP data as a benchmark to compare New Century's loan pool to the broader subprime market.

[Table 2 about here]

In the LP data, the average FICO score for first-lien loans rose from a low of 601 in 2001 to a high of 621 in 2005. In our sample, average FICO scores for first-lien loans increased from 585 to 622 over the same time period. The average loan size increased from 126K in 2001 to 212K in 2006 in the LP data, and from 149K to 217K in our data. The percentage of fixed-rate, balloon and other mortgages ranged from 33%, 7% and 60% in 2001 to 20%, 25% and 55% in 2006 in the LP data, and from 19%, 0% and 81% to 14%, 40% and 46% in the New Century sample.[8] Average combined loan-to-value ratios (CLTVs) are in almost perfect alignment between our and the LP data, from just below 80% in 2001 to 86% in 2006. Debt-to-income ratios are fairly flat and around 40% in both samples. The share of loans with full documentation fell from 77% in 2001 to 62% in 2006 in the LP data, but stayed fairly flat, around 60%, in the New Century data. If we were to combine full and limited documentation loans in the New Century data, the fraction would fall from 64% to 60%. The distribution of the loan purpose for New Century loans is similar to that reported for the LP data. The same is true for mortgage rates, rate margins and the fraction of loans with prepayment penalties. Overall, the origination statistics for the New Century loans in our sample are in line with those for the broader subprime market.

From 1999 onwards, the IPRecovery data contain detailed servicing records for most of the New Century loans. For every year from 1999 to 2006, more than 99% of the funded broker loans are part of the servicing data, except for 2001 (83%) and 2002 (42%). As in Demyanyk and Hemert (2011) and Jiang, Nelson, and Vytlacil (2011), we consider a loan to be delinquent if payments on the loan are 60 days or more late, or if the loan is in foreclosure, real estate owned, or in default.

[7] During our sample period, securitization shares of subprime mortgages ranged between 54% and 76% (Mortgage Market Statistical Annual (2007)).

[8] For New Century and many other subprime lenders, the share of interest-only loans started to increase in 2004 and that of balloon loans in 2005 (Gorton (2010), Landier, Thesmar, and Sraer (2011)).

A report by Moody's (2005) shows that the performance of New Century loans closely tracked that of the subprime industry. We confirm this finding by comparing the cumulative delinquency rates for our data, as shown in Figure 2, with those reported by Demyanyk and Hemert (2011). For the LP (New Century) data, 12-month cumulative delinquency rates are 13% (20%), 9% (13.5%), 7.5% (8.5%), 9% (10%) and 12% (13%) for loans originated in 2001, 2002, 2003, 2004 and 2005, respectively. These delinquency statistics are rather similar, especially for the latter part of the sample. The only two years with larger differences in rates are 2001 and 2002, precisely the years in which a sizable portion of the New Century loans are missing from the servicing data. Given the lack of data, we put less weight on the 2001 and 2002 estimates and verify in robustness checks that our empirical findings are robust to excluding loans originated prior to 2003. One reason that the 2003-2005 delinquency rates for our sample are 1-2 percentage points higher than those reported for the LP data may be that the LP data include retail loans in addition to broker loans. Jiang, Nelson, and Vytlacil (2011) find that broker loans are generally riskier than retail loans.

[Figure 2 about here]

3.2. Broker compensation

Until recently, independent mortgage brokers earned revenues from two sources: a direct fee paid by the borrower and an indirect fee—known as the yield spread premium or YSP—paid by the lender. Direct fees include all compensation associated with the mortgage transaction paid by the borrower directly to the broker, including finance charges such as appraisal and credit report fees. The yield spread premium rewards the broker for originating loans with a higher interest rate, holding other things equal.[9] Table 3 shows that total broker revenues per loan, as a percentage of the loan amount, declined steadily from 4.9% in 1997 to 2.8% in 2006. The decline in percentage revenues was almost equally split between a decline in fees and in YSP. Per-loan dollar revenues, on the other hand, increased over time from 4.2K in 1997 to 5.6K in 2006. This increase in dollar revenues corresponds to an annual compound rate of 3.3% which is similar to the rate of inflation. The decrease in percentage revenues and the relatively modest growth in dollar revenues may reflect an increase in broker competition over time.

[Table 3 about here]

[9]New loan originator compensation rules went in effect April 1, 2011 as part of Regulation Z. They prohibit mortgage broker compensation to vary based on loan terms, other than principal. In particular, brokers can no longer receive yield spread premia from the lender.

The top panel in Figure 3 shows the unconditional distribution of broker revenues and its two components.[10] All three distributions are disperse and skewed to the right—there are some very large fees and yield spreads paid out to brokers. The right skewness in the revenue distribution appears to be a robust feature across different strata of our sample, as documented in the remaining panels in Figure 3, although the skewness is smaller after conditioning on the loan amount.

[Figure 3 about here]

From the first column in the bottom panel of Table 3, brokers are generally rewarded more for originating larger loans. While brokers earn an average 2.2K per loan for mortgages of 50K or less, they earn 9.7K for loans in excess of 500K. Both direct fees and YSP contribute to the increase in revenues as loan amount increases. After controlling for the size of the loan, the variation in revenues is much smaller. Nevertheless, hybrid loans usually generate lower revenues than fixed-rate, balloon and interest-only loans. Borrowers with a lower FICO score often pay higher fees and yield spread premia when compared to higher-credit-quality borrowers. Loans with a prepayment penalty generally offer higher broker revenues, mainly due to higher fees.

During our sample period, almost 56,000 different brokerage firms do business with New Century. Each company consists of one or more individuals working out of the same office. The median brokerage firm has only sporadic contact with New Century, and originates about 4 loans or 734K for this lender between 1997 and 2006. The top three loan originators in our sample are Worth Funding (9,705 loans), United Vision Financial (2,826 loans) and Dana Capital Group (1,446 loans). Our results are robust to excluding loans originated by these three brokerage firms from the data.

Two recent empirical studies that report data on broker fees and yield spread premia. Woodward and Hall (2012) analyze about 1,500 FHA fixed-rate loans originated during a 6-week period in 2001 and report average broker revenues of about $4,100 per loan, and an average loan size of about $113,000. In percentage terms this is comparable to the 2001 statistics we report in Tables 2 and 3, although our dollar values are somewhat higher both for revenues ($4,800) and loan size (149K). Garmaise (2009) studies a sample of almost 24,000 residential single-family mortgages originated between 2004 and 2008. He reports average percentage broker revenues of 2.1%. Neither study, however, focuses on subprime loans. As for the popular press, a news release by 360 Mortgage Group

[10] About 27% of the YSP entries in our data are left blank. All else the same, loans with lower FICO scores, lower risk grades and less documentation are more likely to have a missing YSP entry. Such loans usually have high base rates, leaving less room for brokers to convince borrowers to pay rates in excess of the base rate. Moreover, while a marginal increase in yield spreads is usually associated with a decrease in direct broker fees, we find no statistical significance for a missing-YSP dummy when regressing broker fees on YSP and other observable covariates. With this in mind, we interpret missing-YSP entries as zero YSP, which brings the percentage of zero-YSP loans in our data to 30%. Our findings are robust, however, to excluding missing-YSP loans from the sample.

(Reuters (2011)) on mortgage broker compensation states that brokers generated an average per-loan revenue of 2.25% in recent years.[11] This figure is consistent with the compensation statistics reported in Table 3 and points to a continued decline in percentage broker revenues beyond 2006.

In summary, New Century's loan pool is largely representative of the broader subprime market. Following its bankruptcy in 2007, New Century received widespread attention in the popular press, mainly because it was the largest subprime lender to default by that date. By 2009, however, virtually all of New Century's main competitors had either declared bankruptcy, had been absorbed into other lenders, or had otherwise unwound their lending activities.[12]

4. Broker Charges and Mortgage Credit Risk

In this section, we establish that higher broker charges reflect higher delinquency risk, both unconditionally and when controlling for other risk characteristics.

4.1. The unconditional link between broker charges and mortgage credit risk

The left panel in Figure 1 shows average 12-month delinquency rates for loans sorted by percentage broker revenues. Delinquency rates are the lowest at about 10% for loans with revenues of 1-2% of the loan amount. They increase steadily as percentage revenues increase above 1-2%, and peak at over 19% for loans with percentage revenues of more than 5%. Interestingly, the average delinquency rate for loans with percentage revenues of less than 1% is slightly higher than that for loans with 1-2% revenues, consistent with somewhat higher delinquency rates among very large, low percentage revenue loans. It may also be due to some extremely cash constrained borrowers obtaining small-cost loans.

The link between percentage broker revenues and mortgage credit risk can in part be explained by the fact that revenues proxy for other known risk characteristics. For example, if there are fixed costs associated with originating a loan, percentage broker revenues are likely to be larger for smaller loans. As shown in the middle panel of Figure 1, average percentage revenues decline steadily as the loan size increases, from 4.4% for a 50-75K loan to 2.2% for loans between 300K and 500K. At the same time, the right panel in the figure shows that small loans are generally also the riskier ones. The average 12-month delinquency rate is highest for loans of 50-75K at almost

[11] The news release does not distinguish between prime and subprime mortgage brokers.

[12] New Century was joined on the OCC's 2009 list of the biggest subprime lenders in main metro areas by Long Beach Mortgage, Argent Mortgage, WMC Mortgage, Fremont Investment & Loan, Option One Mortgage, First Franklin, Countrywide, Ameriquest Mortgage, ResMae Mortgage, American Home Mortgage, IndyMac Bank, Greenpoint Mortgage Funding, Wells Fargo, Ownit Mortgage Solutions, Aegis Funding, Peoples Choice Financial, BNC Mortgage, Fieldstone Mortgage, Decision One Mortgage and Delta Funding.

19%, and then decreases as loan size increases to a low of 11.4% for 200-300K loans. Larger loans are again somewhat riskier than medium-sized ones, with a delinquency rate of 11.8% for loans between 300K and 500K.

Overall, small loan size—and hence high percentage revenues—serve as strong unconditional indicators of high delinquency risk. In our data, small loans are often taken out by lower-income borrowers who tend to purchase or refinance homes in neighborhoods with a higher percentage of minorities and a lower percentage of college graduates.

4.2. The conditional link between broker charges and mortgage credit risk

While variables such as size predict broker revenues, we find substantial heterogeneity in broker charges even after controlling for observable loan, property, borrower and broker characteristics. Table 4 shows that 50.7% of the variation in dollar broker revenues can be explained with observable characteristics, and 41.9% of percentage revenues. Broker fees are harder to predict than revenues, as evidenced by the fact that only 40.5% of the variation in dollar fees and 37.8% of the variation in percentage fees can be explained by observable characteristics, including the yield spread premium. The residual fees are skewed to the right, with a skewness coefficient of 0.50 for dollar fees and 0.53 for percentage fees. A sizable fraction of borrowers pay high conditional fees.

[Table 4 about here]

Much of the observed variation in broker fees is explained by the loan amount which, by itself, yields a coefficient of determination of 26.7% for dollar fees and 22.1% for percentage fees. Controlling for YSP in addition to size increases the R^2 for dollar and percentage fees to 32.4% and 25.4%, respectively. A marginal increase in YSP is only partially offset by lower fees, consistent with the findings in Woodward (2003).

We want to understand what the unexplained variation in broker charges reveals about mortgage credit risk. While the recent literature agrees on the definition of the credit event as the time the borrower becomes 60 days delinquent or worse for the first time, different approaches have been used to predict the arrival of these events. A large number of studies apply a duration model methodology and follow Deng (1997), Ambrose and Capone (2000) and Deng, Quigley, and Van Order (2000) who employ Cox proportional hazard models, sometimes with flexible baseline functions (Han and Hausman (1990), Sueyoshi (1992) and McCall (1996)), to predict delinquency risk.[13] Proportional

[13]Applications of Cox proportional hazard models include Calhoun and Deng (2002), Pennington-Cross (2003), Deng, Pavlov, and Yang (2005), Clapp, Deng, and An (2006), Pennington-Cross and Chomsisengphet (2007) and Bajari, Chu, and Park (2011), among others.

hazard models are appealing not only because they allow for flexible default patterns over time but also because they offer a convenient way to incorporate censored observations. An alternative approach is to estimate a probit model as in Danis and Pennigton-Cross (2005), Geradi, Goette, and Meier (2010) and Jiang, Nelson, and Vytlacil (2011). While duration models capture the time between loan origination and credit event, probit models do not distinguish between mortgages that become delinquent at different points in time.

A loan transitions from survival to nonsurvival when it becomes 60 or more days delinquent or defaults for the first time. Since mortgage payments are due on a monthly basis, credit events occur only at discrete points in time (Demyanyk and Hemert (2011)). To establish a link between unobserved broker charges and loan performance we estimate a proportional odds duration model, the discrete-time analogue to the Cox proportional hazard model.[14] For a loan with a given row vector X of characteristics observed at origination, the probability that the loan transitions to the nonsurvival state after m months, conditional on not having been delinquent before, is defined as

$$P_X(m) \quad = \quad \Pr\left(T_D = m | T_D \geq m, X\right),$$

where T_D denotes the time of the credit event.

We assume that the log proportional odds of first-time delinquency at time m are affine in X. In particular,

$$\log \frac{P_X(m)}{1 - P_X(m)} \quad = \quad a_m + X_{\text{comp}} b'_{\text{comp}} + X_{\text{cond}} b'_{\text{cond}}, \tag{7}$$

where a_m captures age effects, and b_{comp} and b_{cond} are row vectors of coefficients. The vector X consists of broker compensation variables, X_{comp}, and a large number of conditioning variables, X_{cond}, that are observed at the time of origination. The latter include loan and property characteristics, borrower characteristics, broker variables, neighborhood and regulation variables, market conditions, and year and location dummies. Some of the continuous conditioning variables are discretized to add flexibility to the log-linear specification in Equation (7). The model is estimated via maximum likelihood techniques under the noninformative censoring assumption.

Our estimation results are summarized in Table 5. The first two columns show the parameter estimates for the case where b_{comp} is equal to zero. The results are consistent with the existing literature on explaining mortgage credit risk in the years prior to the subprime crisis (see, for example, Demyanyk and Hemert (2011) and Jiang, Nelson, and Vytlacil (2011)). Complex mortgages

[14] Probit model estimates confirm our qualitative findings and are available upon request.

tend to have higher delinquency rates than fixed-rate loans. All else the same, piggyback loans, high-LTV loans, limited or stated documentation loans, and loans with prepay penalties are more likely to become delinquent. Refinance mortgages, and especially refinance cash-out mortgages, have a negative marginal effect. Borrowers with higher credit scores and lower debt-to-income ratios default less frequently on their obligations. Loans originated in neighborhoods with a higher fraction of white population or with higher educational attainment exhibit marginally lower delinquency rates. The (unreported) age effects are consisted with the findings in Demyanyk and Hemert (2011) in that the odds of first-time delinquency peaks around the age of 8–14 months. Conditional delinquency rates increased throughout much of our sample period, and peaked in 2006.

[Table 5 about here]

The vector of conditioning variables X_{cond} includes two state-by-state regulation variables. HOEPA sets a baseline for federal regulation of the mortgage market. We follow the approach taken by Ho and Pennington-Cross (2005) and Ho and Pennington-Cross (2006) and construct an index that assigns higher positive values if anti-predatory lending laws for a given state cover more types of mortgages than HOEPA. In addition, Pahl (2007) reports state occupational licensing laws and registration policies for mortgage brokers, which are compiled into an index that has higher values for states with stricter requirements. We find slightly lower marginal delinquency rates for loans originated in states where a wider range of mortgages is covered under anti-predatory lending laws, and significantly lower rates in states with a higher Pahl index of mortgage broker regulation. Broker licensing laws are effective in reducing mortgage credit risk, even when conditioning on other known risk characteristics.

The third and fourth columns of Table 5 show the estimation results when the restriction b_{comp}=0 is lifted and X_{comp} includes percentage broker revenues. We find that a marginal increase in broker revenues by 1% of the loan amount is associated with a 6.2% higher log proportional odds ratio or, equivalently, a exp(0.062)-1=6.4% higher odds ratio. The sample standard deviation of percentage revenues for the loans in the servicing data is 1.46%, hence a one standard deviation increase in these revenues is associated with a 9.1% increase in the log odds of delinquency. A marginal increase in broker revenues may be due to a marginal increase in broker fees or a marginal increase in yield spread premia. We replace X_{comp} by percentage fees and percentage YSP, and report the results in columns five and six of the table. A marginal increase in fees by 1% of the loan amount is associated with a 7.3% higher log proportional odds ratio, or 7.6% higher odds of delinquency. Given a standard deviation of 1.33% for percentage fees, a one standard deviation

increase in these fees is associated with a 9.7% increase in the log odds. In other words, higher unexplained broker fees reveal higher mortgage credit risk, even when conditioning on other risk characteristics.

Because X_{cond} includes lender points and mortgage rates, unobserved heterogeneity in YSP stems from unobserved heterogeneity in YSP schedules rather than conditional variation in mortgage pricing.[15] Our findings suggest that unobserved heterogeneity in yield spread schedules has no significant impact on the odds of first-time delinquency, conditional on the loan and rate chosen by the borrower and broker. It is important to stress, however, that this does not imply that there is no link between YSP and loan performance. On the contrary, untabulated results together with our findings in Table 5 show that, all else the same, more complex loans and loans with a prepay penalty tend to have higher yield spread premia and higher delinquency rates.

4.2.1. Credit score cutoffs

Bubb and Kaufman (2009) argue that many mortgage lenders employed FICO score cutoff rules that required increased scrutiny of loan applications below certain thresholds. Freddie Mac (1995) and Fannie Mae (1997) established FICO scores of 620 and 660 as key cutoffs. For borrowers with FICO scores above 660, lenders were to do a basic review of the loan application to confirm the borrower's ability to repay. For loans with FICO scores between 620 and 660, lenders were to perform a comprehensive review to underwrite all aspects of the borrower's credit history and to establish the borrower's ability to repay. For FICO scores below 620, lenders were to perform a particularly detailed review of the borrower's credit history and consider the unique circumstances of each application to judge if there are compensating factors that offset the higher risk.

Lenders like New Century who sold loans to Fannie Mae or Freddie Mac were contractually obligated to follow the government-sponsored entities' (GSEs') guidelines. They often used automated underwriting systems that hard wired the credit score cutoff rules to identify high credit risk loans for which manual underwriting was necessary. For these loans, the lender considered additional information about the borrower's creditworthiness, such as information about non-standard sources of income, cash reserves and the borrower's explanation of recent income or payment shocks. According to Bubb and Kaufman (2009), this process was followed not only for loans sold to GSEs but also for portfolio loans and loans sold to private-label securitizers.

[15] Whether or not to condition on mortgage rates depends on the objective of the loan performance analysis. Demyanyk and Hemert (2011) argue that subprime loans quality, when adjusted for observable characteristics including interest rates, deteriorated prior to the subprime crisis. Jiang, Nelson, and Vytlacil (2011) predict first-time delinquency rates for different origination channels and documentation levels. They exclude interest rates from the set of predictor variables to avoid endogeneity issues.

Keys, Mukherjee, Seru, and Vig (2009) confirm that subprime lenders screen more rigorously around the 620 FICO score threshold, especially for limited or stated documentation loans. For full documentation loans, they find a lower credit score of 600 to be a significant threshold. If lenders screen loan applications with low FICO scores more thoroughly prior to making a funding decision, brokers are left with less unobserved information that they can use for such loans to extract higher rents. This would imply that there is less unobserved borrower risk revealed through broker fees for low FICO loans than for high FICO loans.

To test this hypothesis, we expand the specification in (7) to allow for interaction terms between fees, FICO scores and the documentation level. The results are reported in the last two columns of Table 5. A marginal increase in percentage broker fees by 1% has a larger impact on the log proportional odds ratio for loans with higher FICO scores than for loans with lower FICO scores, both for full and low documentation mortgages. An increase in percentage fees by 1% is more likely, however, for low credit score loans than for high credit score loans. The sample standard deviation of percentage broker fees ranges from 1.40% to 1.28% for full documentation loans with a FICO score of less than 600 (600− loans) to those with a score of 660 or higher (660+ loans). For limited or stated documentation loans, standard deviations range from 1.38% for 600− loans to 1.12% for 660+ loans.

For loans sorted by documentation level and FICO score, Table 6 reports the product of the marginal coefficient estimate for percentage fees and the standard deviation of these fees. For full documentation loans, the column "All" shows that for 600− and 660+ loans, a one standard deviation increase in percentage broker fees translates into a 8.7% and 20.1% increase in odds ratios. For limited or stated documentation loans, the increase in odds amounts to 6.1% for 600− loans and 20.9% for 660+ loans. While FICO scores of 600 and 660 are the important thresholds for full documentation loans, we observe a substantial increase in marginal effects of broker fees on loan performance at all three thresholds (600, 620 and 660) for low documentation loans.

[Table 6 about here]

Table 6 also reports the marginal effects after conditioning on the size of the loan. Conditional on documentation level and FICO score, there is more variation in the percentage fees of smaller loans than of larger ones, and broker fees reveal more about unobserved delinquency risk for smaller rather than larger loans. Within each size bin, however, we observe an increase in the marginal effect of broker fees on mortgage credit risk as the FICO score increases. Overall, our results confirm that broker fees reveal less unobserved borrower risk for low FICO score loans, that is, for

loans which lenders supposedly screened more vigorously.

4.2.2. Broker charges and mortgage pricing

Our finding that higher fee loans turned out to be riskier ex post holds even after conditioning on lender points and mortgage rates. We analyze whether there where any feedback effects from broker fees to mortgage pricing by estimating the regression

$$\text{Rate} \quad = \quad \alpha + \%\text{Fees}\,\beta_f + \%\text{YSP}\,\beta_y + \widetilde{X}_{\text{cond}}\,\beta'_{\text{cond}} + \varepsilon, \tag{8}$$

for scalars α, β_f and β_y, and a row vector of coefficients β_{cond}. The vector of conditioning variables $\widetilde{X}_{\text{cond}}$ is the same as X_{cond} in Equation (7) except that the "Rate" variable is excluded. The conditioning variables are listed in Table 5 and include lender points.

For $\beta_f = \beta_y = 0$, the regression in (8) yields an R^2 of 0.78.[16] If we lift the constraint on β_y and include percentage YSP in the regression, while keeping β_f at zero, the R^2 increases to 0.85. A marginal increase in percentage YSP by 1% is associated with a significant 52 basis points increase in the initial rate. Our results are consistent with the notion that, all else the same, lenders paid higher yield spreads for mortgages with higher rates. When fees are included in the regression, the estimate for β_f is 0.0056, implying that a 1% increase in percentage broker fees is associated with a 0.56 basis point increase in rates. A one standard deviation increase in percentage YSP and percentage fees yields a 40 and 0.78 basis point increase in mortgage rates, respectively. There were no economically meaningful feedback effects from the fees brokers charged to mortgage rates. Further evidence for this finding is that none of the wholesale rate sheets that we have access to sets base rates as a function of broker fees.

5. Broker Fees as an Input to Mortgage Pricing?

Given that broker fees reveal otherwise unobserved mortgage credit risk, we investigate whether fee-based mortgage pricing is likely to result in higher rates for riskier loans.[17] Consider two borrowers that apply for the same mortgage through the same broker and provide identical information on their respective loan applications. For a given mortgage rate r, the first borrower has a benchmark reservation value for the fees of $\nu_1(r) - o_1(r)$. The second borrower shops from fewer brokers, or both

[16] We do not tabulate the regression results to conserve space. The main findings are described in the text, with more detailed results available upon request. The data consist of all 668,582 loans in our sample.

[17] While we do not claim that loans with conditional high fees were previously underpriced in absolute terms, the results in Section 4 suggest that even after controlling for mortgage pricing loans tended to be riskier.

borrowers shop from only one broker but the second borrower is less informed about the terms of the loan, or both borrowers shop from multiple brokers but origination services are generally more costly for the second borrower. As a result, the second borrower's reservation value $\nu_2(r) - o_2(r)$ exceeds $\nu_1(r) - o_1(r)$. The broker's costs for the first and second borrower are $c_1(r) \leq \nu_1(r) - o_1(r)$ and $c_2(r) \leq \nu_2(r) - o_2(r)$, respectively. To keep things simple, yield spread premia are not permitted.

As long as there are no feedback effects from fees to mortgage pricing, the broker sets the fees for the first and second borrower equal to $f_1(r) = \nu_1(r) - o_1(r)$ and $f_2(r) = \nu_2(r) - o_2(r)$. The lender observes the information provided on the loan application, which is the same for both borrowers, plus the fees charged by the broker. Based on the empirical findings reported earlier, the lender predicts that the second borrower is more risky than the first and hence may consider a fee-based rate schedule where, all else the same, the base rate increases if broker fees exceed $f_1(r)$,

$$\text{Rate} \quad = \quad \begin{cases} r, & \text{if Fee} \leq f_1(r) \\ \bar{r} \geq r, & \text{if Fee} > f_1(r). \end{cases} \tag{9}$$

In what follows, we explain why the rate schedule in (9) may not result in a higher rate for the second borrower. To keep the discussion brief, we abstract from scenarios where the introduction of a fee-based rate schedule impacts $c_1(\cdot)$ or $c_2(\cdot)$, or provides indirect incentives for borrowers to change their shopping strategy. Given the schedule in (9), the broker may still originate the first borrower's loan at rate r for fee $f_1(r)$. The maximum fee that the broker can charge the second borrower is $f_1(r)$ if the loan is made at rate r, where $f_1(r) < \nu_2(r) - o_2(r)$, and it is $f_2(\bar{r}) = \nu_2(\bar{r}) - o_2(\bar{r})$ if the loan is made at rate $\bar{r}$. The broker sets rates and fees so as to maximize her gains from trade. For the second borrower, the broker weighs the option of originating the loan at rate r for a net surplus of $f_1(r) - c_2(r)$ against the option of originating the loan at rate $\bar{r}$ for a net surplus of $f_2(\bar{r}) - c_2(\bar{r})$. If $f_1(r) < c_2(r)$ the only viable option is the higher rate loan, whereas if $f_2(\bar{r}) < c_2(\bar{r})$ the only viable option is the lower rate loan. If the broker cannot cover her costs at either rate, she is no longer willing to originate the loan for the second borrower. If, however, costs are covered at both rates, the broker originates the higher rate loan as long as $f_2(\bar{r}) - c_2(\bar{r}) \geq f_1(r) - c_2(r)$, and the lower rate loan otherwise.

If the second borrower shops from only one broker, his outside option is no mortgage and his reservation value for the fees is the net surplus from purchasing the house or refinancing the mortgage, which is likely to be lower at larger rates. A moderate increase in interest rates from r

to $\bar{r}$ may yield

$$f_2(\bar{r}) - c_2(\bar{r}) \quad \in \quad (f_1(r) - c_2(r), f_2(r) - c_2(r)) \,, \tag{10}$$

especially if costs remain fairly flat in response to marginal rate increases. If (10) holds, the broker sets the second borrower's rate and fees equal to $\bar{r}$ and $f_2(\bar{r})$, respectively. Because the broker can no longer offer the lower rate loan for $f_1(r)$, her net benefits are reduced from $f_2(r) - c_2(r)$ to $f_2(\bar{r}) - c_2(\bar{r})$). The borrower pays the higher rate and his net benefits from the mortgage contract are zero. The lender receives a higher rate for the second borrower's loan. To ensure that (10) holds, the lender would have to have detailed knowledge of the interest rate sensitivity of broker costs and borrower reservation values.

As the increase from r to $\bar{r}$ in (9) becomes steeper, $f_2(\bar{r})$ may eventually drop below the benchmark reservation value $f_1(r)$, and $f_2(\bar{r}) - c_2(\bar{r})$ may decrease below $f_1(r) - c_2(r)$. In that case, the broker would offer the second borrower the same loan as the first borrower—at rate r and fee $f_1(r)$—even though the second borrower is likely to be riskier. The broker no longer obtains all of the joint gains from trade. Instead, the amount $f_2(r) - f_1(r)$ goes to the borrower. The lender receives the same rate from both borrowers even though the second borrower is likely to become delinquent sooner. A necessary condition to prevent the second borrower from having access to the low rate is $c_2(r) > f_1(r)$. If costs for the second borrower exceed fees, the broker is no longer willing to originate a loan for that borrower. Steep increases in rates for loans effectively cap fees at $f_1(r)$, hence impose indirect limits on origination charges. Limits to origination charges may not be effective in setting higher rates for riskier loans. They may restrict access to mortgage credit for riskier loans, but only if origination services are significantly more costly for such loans.

If the borrower receives quotes from multiple brokers and if YSP is not permitted, then the borrower's reservation value is equal to the minimum of the cost of the second-lowest-cost broker and the net surplus from arranging the mortgage. An increase in mortgage rates impacts the borrower's reservation value only if rate increases are associated with changes in broker costs or if they lead to the borrower's net surplus from obtaining the mortgage falling below the second-best cost. If, for example, there is a parallel shift in broker costs as rates increases, and if fees are equal to the second-best bid, we have $f_2(\bar{r}) - c_2(\bar{r}) = f_2(r) - c_2(r) > f_1(r) - c_2(r)$, and the broker originates the high-fee loans. That remains true as long as $f_2(\bar{r}) - c_2(\bar{r}) \geq f_1(r) - c_2(r)$ holds. For steeper increases in rates, however, the borrower's net surplus from obtaining the high rate mortgage will eventually fall below the second-best cost and $f_1(r)$, in which case the discussion

from the single broker case applies.

In summary, establishing a fee-based rate schedule that yields a higher rate for the second borrower requires detailed knowledge of broker costs and borrower reservation values. A substantial increase in rates at the fee threshold may keep brokers from charging higher rates or higher fees for marginally riskier loans. While fee-based rate schedules may not be effective in compensating lenders for higher delinquency risk, they may very well be successful in protecting borrowers from paying large margins above costs. As long as the increase in rates is sufficiently steep and $f_2(\bar{r}) - c_2(\bar{r}) < f_1(r) - c_2(r)$, the broker has to pass on a portion of the gains from trade to the borrower. Our discussion emphasizes that restrictions on mortgage broker compensation are more likely to be effective in limiting broker profits than in protecting lenders, and ultimately investors, from unobserved mortgage credit risk.

5.1. Performance-based funding decisions

An alternative way for lenders to incentivize brokers to reveal otherwise unobserved credit risk is to track past broker performance and screen loan applications submitted by brokers with abnormally high mortgage default rates more thoroughly. Lenders may offer the best rates only to brokers with a good performance record, or reject applications submitted by underperforming brokers more frequently. Performance based funding decisions may, however, be difficult to enforce. In our data, the average broker originated only four loans for New Century over a 10-year period. The scarcity in historical broker-level performance data poses a hurdle to lenders tracking broker-by-broker performance statistics.

5.2. Profit sharing

Since fee-based rate schedules, limits on origination charges or performance-based funding decisions may not be effective in exploiting the conditional link between broker fees and delinquency risk, we offer a proposal for discussion that would ensure risk sharing between the broker and the lender. Suppose that prior to closing the broker discloses to the lender the fees she is charging the borrower. In the setting of our earlier example, the broker receives all her fees $f_1(r)$ at the time the loan for the first borrower closes. For the second borrower, the broker charges a higher fee of $f_2(r)$, but receives only a portion of it, namely $f_1(r)$, at closing. The remaining amount, $f_2(r) - f_1(r)$, is held in trust by the lender or a third party for m months or until the loan becomes delinquent, whichever occurs first. If the loan does not become delinquent within m months of origination, the accrued value of $f_2(r) - f_1(r)$ is paid to the broker, otherwise that amount goes to the lender. The waiting period of m months can be set as a function of the broker's past interactions with

the lender, among other variables. As long as $f_1(r)$ represents a benchmark conditional broker fee, this approach exploits the unobserved heterogeneity in broker charges to reduce the lender's risk exposure. For loans that are sold and securitized, it is in the interest of secondary market investors to incentivize lenders to disclose origination charges together with other observable characteristics, or to pass along payouts from conditional high fees in the event of an early delinquency.[18]

In what follows, we describe a regulatory proposal that ties broker charges to mortgage credit risk and discuss its potential impact on loan performance, access to mortgages and broker revenues.

6. The QRM Proposal

In response to the fallout from the subprime crisis, Congress enacted credit risk retention requirements as part of the Dodd-Frank Act. The rulemaking requires issuers of securitizations to keep "skin in the game" by retaining at least 5% of the credit risk of each securitization. Permissible forms of risk retention include, among others, a vertical slice of the structured deal's interests where specified pro rate pieces of each subordination tranche are retained, or a horizontal first-loss position (Agencies (2011)). Dodd-Frank exempts certain securitizations from the risk retention requirements, including deals collateralized exclusively by government-backed securities or by Qualified Residential Mortgages. Some observers predict that non-exempt mortgages will be significantly more costly for borrowers—by as much as 2-3%—or not be available at all (NAMB (2011), Freedman (2011), Zandi and deRitis (2011)).

The QRM term is to be defined jointly by six regulatory agencies. The "Agencies" include the Office of the Comptroller of the Currency, the Federal Reserve Board, the Federal Deposit Insurance Corporation, the Securities and Exchange Commission, the Department of Housing and Urban Development and the Federal Housing Finance Agency. In March 2011, the Agencies published a proposal of QRM guidelines for public comment.[19] Dodd-Frank provides that the risk retention rule will become effective for residential mortgage-backed securities one year after publication of the final QRM rule. The final rule has not yet been issued, and indications are a new QRM proposal may be drafted instead.[20]

The stated objective of the current QRM proposal is to ensure that QRM loans have "low credit risk even in stressful economic environments" (Agencies (2011)). The QRM guidelines can

[18] Hartman-Glaser, Piskorski, and Tchistyi (2011) discuss the optimal contract between the securitizer and investors.

[19] Such comments have since been submitted by the National Association of Mortgage Brokers (NABM, www.namb.org), the National Association of Realtors (NAR, www.realtor.org) and the private mortgage insurance industry (MCIA, www.micanews.com), among many others.

[20] For details, see www.acuma.org/wp/2012/regulators-expected-to-pull-qrm-rule-and-issue-another/.

be summarized in the form of the eight rules listed in Table 7. One of the proposed restrictions, QRM Rule 8, stipulates that origination charges payable by the borrower in connection with the mortgage transaction may not exceed 3% of the loan amount. As a result, loans that do not qualify for QRM status can be originated only at higher rates. In light of our discussion in the previous section, we are hesitant to believe that the proposed limit on origination charges will be effective in excluding mortgages with unobserved credit risk from QRM status. The limit on origination charges may yield, however, lower delinquency rates for QRM loans by excluding smaller loans from QRM status (Section 4.1). It may also lower broker profits and protect borrowers from being charged high margins above costs (Section 5).

[Table 7 about here]

"Origination charges" are defined in the Federal Reserve Board's Regulation Z (12 CFR section 226.4) and include *(i)* all compensation paid directly or indirectly by the borrower or lender to the mortgage originator, *(ii)* finance charges (sections 226.4(a) and 226.4(b)) such as appraisal and credit report fees, but excluding interest and time price differentials, *(iii)* real-estate related fees (section 226.4(c)(7)) such as title insurance and notary fees, unless reasonable, *(iv)* credit insurance premia and debt cancellation or suspension fees, and *(v)* prepayment penalties incurred by the borrower for a previous loan held by the same lender.

For the loans in our sample, the observed broker revenues are a tight lower bound for the origination charges. The revenues consist of all compensation paid directly or indirectly by the borrower to the broker, and include finance charges such as appraisal and credit report fees. We believe that the observed broker revenues account for the vast majority of the borrower's origination charges. Our data suggest that additional fees such as credit insurance premia, debt cancellation or suspension fees, or prepayment penalties for previous loans account—when reported—for only a small portion of the borrower's cash charges.

The additional QRM rules restrict QRM eligibility to first lien loans on a one-to-four family residential property to be purchased or refinanced as a principal residence. The maturity of the loan cannot exceed 30 years, and the borrower must have a clean credit history. The maximum permitted loan-to-value ratio is 80% in a purchase transaction, 75% in a refinance transaction, and 70% in a cash-out refinance situation. The borrower's debt-to-income ratio cannot exceed 36%, and income and financial resources must be verified and documented. Prepayment penalties are not permitted and the loan cannot have payment terms that allow for balloon payments, interest-only payments or negative amortization.

Only a few empirical studies have analyzed the potential impact of the proposed QRM rules. The Agencies (2011) investigate QRM Rules 2, 4 and 7, whereas the U.S. Government Accountability Office (GAO (2011)) analyzes QRM Rules 1, 3 and 7. Our paper is the first to study the impact of QRM Rule 8, both as a stand-alone rule and in association with other QRM rules.

7. Estimating Marginal Broker Costs

The proposed limit on origination charges for QRM loans is guaranteed to exclude a loan from QRM status only if the broker's cost exceeds the maximum permissible charge. To derive cost estimates, consider a borrower i and a broker j. The broker's cost is given by $c_{i,j} = c_{i,j}(X_i, X_j)$, where X_i denotes the row vector of observable characteristics X_{cond} but excludes broker-specific variables which are collected in X_j. As before, "observable" refers to data observed by the econometrician. Different values of X_j identify different types of brokers, such as high versus low volume brokers, rookie versus seasoned brokers or local versus national brokers.[21] In our analysis, X_j is a binary "active broker" variable that distinguishes between two types of brokers. At any point in time, active brokers are those who submitted five or more loan applications to New Century in the previous month and inactive brokers are those who submitted no more than two applications.[22]

Equation (5) relates observed broker revenues to costs, as a function of the borrower's shopping behavior. While we do not observe borrowers' shopping efforts, Lacko and Pappalardo (2007) and a Federal Reserve Board (2008) survey find that many but not all borrowers shop from only one broker. For a given set of observable characteristics X_i and X_j, and holding YSP fixed, the revenue distribution defined by (5) is a mixture of two unknown distributions—those of broker costs and of borrowers' net surplus from obtaining the mortgage—with unknown proportions. Estimating costs from observed revenues therefore requires strong parametric assumptions.

As a tradeoff between the need for loan-level cost estimates and the pitfalls of model misspecification, we consider a range of cost specifications spanned by two polar cases. In the first case, the broker's cost $c_{i,j}$ is set equal to the minimum revenue observed for loans with characteristics X_i and X_j, $\underline{c}(X_i, X_j)$. Unless all loans with X_i and X_j are intermediated above cost, $\underline{c}(X_i, X_j)$ is a lower bound on conditional costs. If at least some loans are made at cost, $c_{i,j} = \underline{c}(X_i, X_j)$ is consistent with a scenario where borrowers shop from a single broker ($K = 1$) and there is no

[21] New Century tracked past broker activity by recording the broker-specific number and volume of loan applications submitted in the previous month. The number and volume of funded loans was also recorded.

[22] About one-third of the loans in our sample are originated by active brokers. In a number of tables, we also report results for a "Broker competition" variable. This variable, however, is measured at the zip-code level rather than the individual broker level.

unobserved heterogeneity in costs. We refer to the first case as the perfect rent extraction case.

In the second case, the broker's cost $c_{i,j}$ is set equal to the observed revenue. Revenues provide an upper bound on costs, as dictated by the broker's participation constraint. The case $c_{i,j} = \text{revenue}_{i,j}$ is consistent with a scenario where borrowers shop from multiple brokers ($K > 1$) with the same cost. Suppose that costs for borrower i are the same across all brokers of type X_j, so that $c_{i,j} = \bar{c}(i, X_i, X_j)$. If borrowers observe broker types, have a preference for a type of broker and shop from two or more brokers of that type, loans are intermediated at cost and $c_{i,j} = \text{revenue}_{i,j} = \bar{c}(i, X_i, X_j)$. Any unobserved heterogeneity in costs stems from heterogeneity across borrowers. Brokers may learn about borrower characteristics that are not disclosed on the loan application but are likely to affect the brokers' time costs, such as the borrower needing extra prodding or close supervision while preparing the loan documents.[23] That said, broker costs for a given borrower i may differ across brokers of different types. We refer to the second case as the perfect competition case, short for perfect competition among brokers of the same type.

We consider cost functions of the form

$$c_{i,j}^{w} \quad = \quad (1-w)\,\underline{c}(X_i, X_j) + w\,\bar{c}(i, X_i, X_j), \qquad \text{for } w \in [0,1], \tag{11}$$

where $w = 0$ yields costs under perfect rent extraction and $w = 1$ yields costs under perfect competition. $\bar{c}(i, X_i, X_j)$ is observed directly as the broker revenue, and minimum conditional revenues $\underline{c}(X_i, X_j)$ can be approximated in a robust fashion by a low quantile of the conditional broker revenue distribution, $q_\alpha(X_i, X_j)$ for α small (Chernozhukov (2000), Liu, Laporte, and Ferguson (2007)). We set $\alpha = 0.05$ and estimate the 5^{th} percent quantile by fitting the quantile regression

$$q_{0.05}(X_i, X_j) \quad = \quad \gamma_0 + (X_i, X_j)\,\gamma', \tag{12}$$

where γ_0 is a scalar and γ a row vector of coefficients. The conditioning variables (X_i, X_j) are the loan, property, borrower and broker characteristics listed in Table 5. We also control for neighborhood and regulation variables, market conditions, and year and location dummies.[24]

To visualize the range of cost distributions generated by Equation (11), Figure 4 plots the unconditional cost distributions $c^w = (1-w)\underline{c} + w\bar{c}(i)$. The figure shows that, as w increases from 0 to 1, cost estimates shift from a narrow distribution at small values to more and more disperse and

[23] Woodward and Hall (2012) do not observe broker characteristics and assume that all unobserved heterogeneity in broker costs stems from heterogeneity in costs across brokers. As a result, they cannot identify broker costs in cases where the borrower shops from only one broker.

[24] Estimates for γ_0 and γ are available upon request.

right-skewed distributions with some very large values. The pattern persists even after conditioning on the variables in (X_i, X_j).

[Figure 4 about here]

Table 8 presents average cost estimates for different values of w. Average dollar costs ranged from 2.2K per loan for $w = 0$ to 5.3K for $w = 1$, whereas average percentage costs ranged from 1.4% for $w = 0$ to 3.2% for $w = 1$. While dollar costs showed a moderate increase throughout much of our sample period, percentage costs fell sharply. Independent of w, costs were increasing and concave in the loan amount. We observe sizable costs even for the smallest loans, consistent with sizable fixed costs associated with loan origination. Table 9 reveals that after conditioning on loan amount, the variation in costs is substantially smaller. Conditional on size, it is slightly more costly to originate cash out refinance loans, more complex loans, piggyback loans, loans for borrowers of lower credit quality, and loans in neighborhoods with a higher percentage of minorities. Costs are estimated to be somewhat higher for primary residences than for second homes or investment properties, and for loans that are originated by active versus inactive brokers. Perhaps active brokers are larger brokerage firms with higher fixed costs per loan than less active brokers because they need to spend more to provide the level of service borrowers associate with that type of broker, or because they are in markets where it is costly to keep new brokers from entering. As a robustness check we re-estimate broker costs for different strata of loans and verify that our cost estimates are similar whether or not the model in (11) is estimated on the full sample or on stratified samples.

[Tables 8 and 9 about here]

Marginal broker profits are measured as the difference between broker revenues and costs. During our sample period, average broker profits ranged from 3.1K per loan in the perfect rent extraction case (w=0) to zero in the perfect competition case (w=1). Because the level of the cost estimates in the perfect competition case seems rather high, and in light of the evidence in Lacko and Pappalardo (2007) and the Federal Reserve Board (2008) who find that many borrowers shop from only one broker, we believe that many of the observed revenues do indeed reflect positive marginal profits. For $w < 1$, Table 8 shows that borrowers who took out larger loans paid substantially higher margins above costs than borrowers who took out smaller loans. Our findings suggest that brokers benefitted from steering borrowers towards larger loans. Brokers may also have been willing to expand additional efforts to attract borrowers that purchase or refinance large homes. After conditioning on loan size, the variation in profits is substantially smaller (see Table 9).

8. The Potential Impact of QRM Rule 8

For a wide range of broker cost specifications, we show that the proposed QRM Rule 8 is likely to reduce delinquency risk by restricting access to mortgage credit for small loans. We argue that it may be less effective in incentivizing mortgage brokers to reveal otherwise unobserved borrower risk, or in protecting large borrowers from paying high margins above costs. We base our argument on an ex-post analysis of the impact of a 3% limit on origination charges on the loans in our sample.

The top panel of Table 10 reports descriptive statistics for two sets of loans: those with percentage broker costs of 3% or less, and those with costs in excess of 3%. In the perfect competition case (w=1), 48% of the loans have costs above the 3% cutoff. Higher percentage cost loans are more likely to become delinquent when compared to lower percentage cost loans, with average 12-month delinquency rates of 16% compared to 11%. High percentage cost loans are generally taken out by borrowers with low FICO scores and a low monthly income who purchase or refinance homes in neighborhoods with a higher percentage of minorities and a lower percentage of college graduates. However, the most dramatic difference between high and low percentage cost loans comes from a comparison of the size of the loans. Mortgages with percentage costs of 3% or less have an average size of over 236K, whereas higher percentage cost loans are on average much smaller at 140K.

[Table 10 about here]

Table 10 reports similar descriptive statistics for alternative cost specifications. As cost estimates shift from the perfect competition case ($w = 1$) to the perfect rent extraction case ($w = 0$), fewer and fewer loans violate the 3% cap. At the same time, the gap in loan amount, FICO scores, borrower income, neighborhood characteristics and delinquency rates between loans that do and do not meet the 3% requirement widens. For $w = 0$, percentage costs exceed the 3% threshold for only 2.5% of the loans in our sample. The average size of the high percentage cost loans is very small at 58K, compared to 193K for all other loans. Average 12-month delinquency rates are 25% for high percentage cost loans and 13% for lower percentage cost loans.

8.1. QRM Rule 8 acts largely as a size rule

Given our discussion in Section 4.1 and the results in Table 8, it is not surprising that the proposed 3% limit on origination charges is more binding for smaller loans than for larger loans. For cost estimates $c^{0.5}$, Table 11 shows that the 3% cap is violated for 70% of the loans of 50K or less, for 57% of the 50-75K loans and for 37% of the 75-100K loans. In comparison, only 17% of the 100-200K loans, 4% of the 200-300K loans and less than 1% of the 300K+ loans have broker

costs in excess of 3%. The larger the loan amount the less likely it is that loans are excluded from QRM status because of the 3% limit on origination charges. For medium-sized and especially for large loans, brokers have little incentive to reveal otherwise unobserved borrower risk.

[Table 11 about here]

As a result, the decrease in delinquency rates from the full sample to one that includes only loans that satisfy the 3% limit is more pronounced for smaller loans than for larger loans. Specifically, 12-month delinquency rates decrease from 17.0% to 13.1% for loans of 50K or less, from 19.0% to 15.1% for 50-75K loans and from 15.1% to 13.0% for 75-100K loans. In comparison, delinquency rates decrease from 12.4% to 11.5% for 100-200K loans, from 11.4% to 11.1% for 200-300K loans, and remain nearly unchanged for 300K+ loans. Overall, average 12-month delinquency rates decrease from 13.3% for the full sample to 11.9% when loans with costs in excess of 3% are excluded.

8.2. Profit contraction for QRM loans

While the stated goal of the proposed QRM definition is to identify low-credit-risk loans, limits on origination charges have historically been imposed to fight predatory lending. Predatory lending is broadly defined as imposing unfair or abusive loan terms on borrowers.[25] HOEPA Section 32 attempts to counteract predatory lending by enforcing strict disclosure requirements and imposing restrictions on product features for loans with high rates or high origination charges.[26] Government-sponsored agencies do not buy Section 32 mortgages, which provides additional incentives for lenders to avoid such loans. Less than 0.2% of the loans in our data are Section 32 mortgages.

The limit on origination charges for Section 32 mortgages is generally much larger than that proposed by QRM Rule 8.[27] As a result, QRM Rule 8 imposes significantly tighter restrictions on broker compensation than the HOEPA guidelines. In what follows, we describe the potential impact of a 3% cap on origination charges on broker revenues. For each loan, we compute the marginal broker profit as the difference between the broker's revenue and cost. Assuming that the broker's cost of originating a loan are the same whether or not QRM requirements are imposed, any reduction in revenues as a result the requirements translates into a reduction in broker profits.

[25] For details, see www.fdicoig.gov/reports06/06-011.pdf. Although predatory lending occurs across all demographics, subprime borrowers have been the more likely targets (see Bond, Musto, and Yilmaz (2009) and Freddie Mac (2012), among others).

[26] For a summary of HOEPA, state and agency high cost loan policies, see www.ftc.gov/bcp/edu/pubs/ consumer/homes/rea19.shtm. Fannie Mae's and Freddie Mac's anti-predatory lending requirements are available online at www.efanniemae.com and www.freddiemac.com.

[27] HOEPA Section 32 defines high-fee loans as loans for which total origination charges exceed the larger of $592 or 8% of the loan amount. See Footnote 5.

We focus on loans which cost the broker no more than 3% of the loan amount to intermediate, that is loans that may be originated in accordance with QRM Rule 8. Table 12 shows that for the perfect rent extraction case (w=0 in Equation (11)), average broker profits are reduced by $719 per loan when origination charges are limited to 3%. The reduction in broker profits is more pronounced for small and medium-sized loans than for large loans, mainly because the larger the loan amount the less likely it is that broker revenues exceed the 3% cap (Table 11). As the assumption underlying the cost estimates shifts from the perfect rent extraction case to the perfect competition case, the impact of QRM Rule 8 on broker profits becomes smaller across all loan sizes.

[Table 12 about here]

The results in Table 12 indicate that the proposed 3% limit on origination charges does not reduce the profit differential between large and small loans in any significant way. Even with QRM Rule 8 in place, brokers may benefit from steering borrowers towards larger loans and may expand extra efforts to attract borrowers that purchase or refinance large homes.

8.3. Stress testing alternative specifications for QRM Rule 8

Large broker profits indicate that the broker overcharges the borrower relative to the broker's cost of intermediating the loan. Brokers are able to extract large profits from borrowers that do not shop around, especially if borrowers are confused about the terms of the loan or have negative information about their future financial situation that the lender does not observe. We show that borrowers are better protected from being overcharged if the proposed 3% limit is replaced by a concave cap on origination charges, mainly because broker costs are a concave rather than linear function of loan size ([Table 8). It is important, however, to keep in mind that high broker profits may indicate unobserved borrower risk, especially when there is little unobserved heterogeneity in broker costs as in the perfect rent extraction case. In that sense, limits on origination charges may make mortgage credit more affordable for borrowers who turn out to be riskier ex post.

That said, consider an alternative specification of the proposed QRM Rule 8 that restricts origination charges to 3% for loans of size 200K or less and to 10K for loans of more than 500K. In between, maximum dollar charges grow according to a piecewise linear schedule that caps origination charges at 8K and 9K for loans 300K and 400K loans, respectively.[28] Figure 5 contrasts the alternative rule with QRM Rule 8, and highlights that the alternative specification imposes tighter restrictions on origination charges for loans in excess of 200K.

[28] To propose an alternative specification, we computed average broker costs c^1 for loans of size 100K, 200K, ..., 1,000K and used these estimates to derive a piecewise linear threshold for origination charges.

[Figure 5 about here]

The middle panel of Table 11 shows that the alternative to QRM Rule 8 excludes only few additional loans, except for the most conservative cost estimates. The fraction of loans that satisfy the alternative restriction on origination charges is 97.5%, 92.3%, 78.4%, 60.1% and 46.2% for cost estimates c^0, $c^{0.25}$, $c^{0.5}$, $c^{0.75}$ and c^1, respectively. This compares to 97.5%, 92.3%, 79.8%, 64.8% and 51.9% for QRM Rule 8. Average 12-month delinquency rates are no higher under the alternative specification than under QRM Rule 8. If anything, for large loans and cost estimates $c^{0.5}$, $c^{0.75}$ and c^1, they are lower under the alternative rule than under the original rule.

Broker profits for medium-sized loans and especially for large loans are substantially smaller under the alternative specification of QRM Rule 8 than under the original one. For the perfect rent extraction case (w=0), Table 12 reports average broker profits of \$1,750, \$2,973, \$4,104 and \$5,722 for 100-200K, 200-300K, 300-500K and 500K+ loans under the concave cap on origination charges compared to profits of \$1,753, \$3,170, \$4,914 and \$7,222 under the linear cap. For cost estimates $c^{0.5}$, average profits are \$707, \$1,183, \$1,586 and \$2,132 for 100-200K, 200-300K, 300-500K and 500K+ loans under the concave cap, and \$710, \$1,329, \$2,263 and \$3,602 under the linear cap. Overall, the concave limit on origination charges is more effective in narrowing the profit differential between large and small loans than the proposed QRM Rule 8.

8.4. Interaction of Rule 8 with other QRM rules

The bottom panel of Table 10 reports descriptive statistics for QRM Rules 1 through 7.[29] Each of the proposed rules has at least some success in reducing delinquency rates. Rule 3 that imposes restrictions on payment terms and Rule 7 that imposes ability to repay requirements are the most restrictive rules. They are also the most effective rules in terms of reducing delinquency rates.[30] Compared to Rule 8, no other rule creates a similar spread in loan amount, borrower income and neighborhood characteristics between QRM and non-QRM loans. While QRM Rules 1, 2, 4 and 5 are satisfied by roughly equal fractions of loans within each size bin, Rules 3 and 7 are somewhat more restrictive for larger loans as opposed to smaller loans as is the case for QRM Rule 8 (Table 11).

Table 12 shows the average broker profits for loans that satisfy one of the QRM Rules 1 through 7 in addition to Rule 8. For the perfect rent extraction case, the lowest average profits are obtained if Rules 3 and 8 are imposed (\$1,614) or if Rules 7 and 8 are imposed (\$1,705). While these profits

[29] Rule 6 is excluded because we cannot verify whether appraisals conformed to accepted standards.

[30] Rule 3 would have eliminated more than 95% of the loans in our sample, because it prohibits prepayment penalties which were present for almost 80% of the loans, and because it requires hybrid loans to have a lifetime cap on rate increases of 6% rather than the 7% cap observed for most of New Century's hybrid loans.

are low in comparison to the average profit of $2,408 obtained when Rule 8 is imposed as a stand-alone rule, the lower profits come at the expense of excluding a large portion of loans. For the perfect competition case, profits are the smallest when Rule 4 that limits LTV ratios is imposed in addition to Rule 8. Similar observations apply to the alternative specification of QRM Rule 8.

9. Conclusion

Based on a sample of more than 600,000 brokered New Century loans, we document that borrowers were charged higher broker fees for loans that turned out to be riskier ex post. Conditional on observable characteristics, that is characteristics observed by the lender and econometrician, a marginal increase in percentage fees by 1% is associated with 7.6% higher odds of delinquency. We employ a simple model of bargaining between the borrower and broker where the broker's information set subsumes that of the borrower and the broker has all the bargaining power. Borrowers shop from one or more brokers according to a second-price auction process. Conditional on observable characteristics, brokers extract higher fees from borrowers that shop from fewer brokers, especially from borrowers with a high valuation for the loan that shop from only a single broker, or from borrowers for which broker costs are perceived to be higher.

Our model and empirical evidence suggest that borrower attributes such as shopping behavior, valuation for the loan and borrower-specific broker costs predict mortgage credit risk even when conditioning on other risk characteristics. Because the lender and the econometrician observe these borrower attributes only through the fees that the broker charges, the attributes cannot be incorporated directly into the lender's funding decision or rate schedule. Moreover, broker-fee-based mortgage pricing is unlikely to yield higher rates for riskier loans as long as brokers are willing to originate loans with unobserved borrower risk at reduced fees.

If the goal is to protect lenders and investors from unobserved borrower risk, we recommend that—instead of imposing feedback effects from broker fees to loan terms—only a portion of the fees is paid to the broker at closing. The remaining fees are placed in a trust for a certain number of months or until the loan becomes delinquent, whichever occurs first. If the loan remains active throughout the waiting period, the accrued value of the remaining fees is paid to the broker, otherwise that amount goes to the lender or the investor. If the fee received at closing represents a benchmark conditional broker fee, our proposed strategy exploits the unobserved heterogeneity in fees to reduce the creditor's risk exposure, without imposing additional constraints on access to mortgage credit.

The link between broker compensation and mortgage credit risk is particularly relevant in light of recent regulatory efforts aimed at identifying low-credit-risk loans. The Qualified Residential Mortgage guidelines, jointly proposed by six government agencies in March 2011, define low-credit-risk loans as loans with percentage origination charges of 3% or less, among other requirements. We show that average delinquency rates are indeed lower for the subset of loans in our sample that may be originated for 3% of the loan amount or less, that is the subset of loans with percentage broker costs of 3% or less, than for the full sample. The finding holds for a wide range of broker cost specifications, spanned by a lower bound that sets costs equal to minimum conditional revenues and an upper bound that sets costs equal to observed broker revenues.

High percentage cost loans are more likely to become delinquent than low percentage cost loans. At the same time, high percentage cost loans are generally much smaller than low percentage cost loans. As a result, the 3% limit on origination charges reduces delinquency risk among QRM loans by disproportionately excluding smaller loans from QRM status. Smaller loans are more prevalent among borrowers with low FICO scores and a low monthly income who purchase or refinance homes in neighborhoods with a higher percentage of minorities and a lower percentage of college graduates. For medium-sized and especially for large loans, the proposed 3% limit is less binding and may not deter brokers from originating loans with unobserved borrower risk as QRM loans.

Limits on origination charges have historically been imposed to fight predatory lending. If the goal is to protect borrowers from paying high margins above broker costs, we recommend a concave rather than a linear limit on origination charges mainly because costs are a concave rather than linear function of loan size. A 3% cap on origination charges reduces marginal broker profits—defined as the difference between revenues and costs—by as much as $700 per loan, depending on the cost estimates. The linear cap does not, however, reduce the profit differential between large and small loans. Even with the 3% cap in place, brokers may benefit from steering borrowers towards larger loans and may expand extra efforts to attract large borrowers. We offer a roadmap for stress testing alternative QRM definitions, and show that a concave ceiling on origination charges is more effective in protecting borrowers of large loans from paying high margins above costs.

While the subprime mortgage market came to a virtual standstill following the 2007-8 crisis, recent forecasts point to a renewed allure of subprime mortgage backed securities (Ahmed (2012)). Our work contributes to the ongoing discussion of credit risk retention requirements for residential mortgages, and the proposed QRM exemption criteria, by highlighting the link between broker compensation and mortgage credit risk.

A. Data Description and Sample Construction

The raw New Century data contains 3.2 million loans. We keep all wholesale loan applications between 1997 and 2006 that were either funded, declined or withdrawn. We require records to contain the broker id, the property zip code, a loan amount between 10K and 1,000K, a combined loan-to-value ratio between 0 and 150, a FICO score between 300 and 850, a debt-to-income ratio between 0 and 100, and a mortgage rate between 0 and 25%. This leaves us with roughly 1.5 million brokered loans, which are used to compute broker variables. We then restrict the sample to include only funded loans, which yields roughly 768,000 observations.

To identify piggyback loans we search for a matching first lien for any second lien loan. We match on the funding date, the borrower's age and FICO score, the appraisal value, the loan purpose, the occupancy status, and the property city and zip code. We obtain a match for the vast majority of second liens. Second lien loans that cannot be matched are dropped, so that data is composed of free-standing first liens and piggyback loans. We do not observe whether a borrower with a free-standing first lien took out a second lien with another lender. While New Century did not typically originate free-standing second liens, this may or may not be true for other lenders and the fraction of piggybacks in our data should be viewed as a lower bound. Each match of a first and second lien is treated as one loan record. Broker fees and YSP are aggregated over the first and second lien. For all other characteristics, piggybacks are categorized based on the properties of the first lien. We require loan records to have data on all observable characteristics used in our empirical analysis. We trim the sample by excluding loans with broker revenues in excess of $17.5K, which account for less than 1% of the data. Our final sample includes 668,582 funded broker loans.

The number of loans in our sample grew exponentially, from about 3,000 loans originated in 1997 to 143,000 in 2006. Piggyback loans became popular from 2004 onwards. The average size of loans grew from about 100K in 1997 to more than 200K in 2006, with higher average amounts for piggybacks. The number of brokers used by New Century in any given year grew dramatically, from about 900 in 1997 to 26,000 in 2006. Over the sample period, about 669,000 loans were originated by 56,000 independent brokers with an average size of 190K.

Our sample represents subprime loans from all parts of the country, with California, Florida and Texas being the three biggest markets. About 90% of all loans were originated in metropolitan areas. Approximately two-thirds of the loans were taken out to refinance existing loans, and the majority of the refinance mortgages involved cash-out payments to the borrower. For the whole sample period, hybrid loans were the most common ones followed by fixed-rate loans. In the last

two years, loans with balloon and interest-only payments became more popular, reaching 54% of the loans in 2006. For most of the sample period, the 2/28 hybrid dominates in the hybrid category and the 30-year fixed-rate loan in the fixed-rate category. The majority of loans came with a product-specific prepayment penalty.

Like other subprime lenders, New Century had three levels of income documentation: full, limited and stated. For a full documentation loan, the applicant was required to submit two written forms of income verification showing stable income for at least twelve months. With limited documentation, the prospective borrower was generally required to submit six months of bank statements. For stated documentation loans, verification of the amount of monthly income the applicant stated on the loan application was not required, and these mortgages were often referred to as "liar loans". The fraction of limited and stated documentation loans varied between 33% in 1997 and 47% in 2004.

The majority of the loans were obtained for a single-family home that serves as the borrower's primary residence. The average borrower FICO score fell almost 30 points between 1997 and 2001, before rising again by roughly the same amount during the second half of the sample. Piggyback loans were made to borrowers with relatively high credit scores, but presumably no cash savings. The borrowers who took out low documentation loans usually had higher credit scores than those that provided full documentation. Even though the average combined monthly income rose from 5.4K in 1997 to 7.2K in 2006, debt-to-income ratios increased slightly, from 37% in 1997 to 41% in 2006. Loan amounts grew not only relative to income levels, but also relative to property values. LTV ratios rose from 73% in 1997 to 80% later in the sample, as second liens gained in popularity.

From 1999 onwards, the data contain detailed servicing records for most loans. We consider a loan to be delinquent if payments are 60 days or more late, or if the loan is in foreclosure, real estate owned or in default. For each year k, let $\widehat{p}_s^k$ denote the number of vintage-k loans experiencing a first-time delinquency s months after origination, divided by the number of vintage-k loans that are still active after s months or experience a first-time delinquency at age s. The cumulative delinquency rate of vintage-k loans at age t is

$$\widehat{P}_t^k \quad = \quad 1 - \prod_{s=1}^{t} \left(1 - \widehat{p}_s^k\right), \quad \text{for } k = 1999, \ldots, 2006.$$

Figure 2 plots $\widehat{P}_t^k$ as a function of the age of the loan t and vintage k. In Section 4 we show that after controlling for year-by-year variation in loan-level characteristics, loans originated in 2004 and 2005 were riskier than loans originated earlier in the sample.

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Table 1: **List of Variables**

Variable	Description
	Loan Characteristics
Rate	Initial mortgage rate in %
Loan amount	Loan amount in thousands of dollars
Hybrid	Indicator for 2/28 or 3/37 loans
FRM	Indicator for 15-, 20- or 30-year fixed-rate mortgages
Balloon/IO	Indicator for mortgages with a balloon or interest-only payments
Piggyback	Indicator for a matched pair of a 1st and a 2nd lien loan*
Limited or stated doc	Indicator for a limited or stated documentation loan
Prepay penalty	Indicator for a loan with a prepayment penalty
Refi, cash out	Indicator for a cash-out refinancing
Refi, no cash out	Indicator for a no-cash-out refinancing
LTV	Loan-to-value ratio, i.e. the value of the first lien divided by that of the house, in %
CLTV	Combined loan-to-value ratio, i.e. the value of all liens on the house divided by the value of the house, in %
	Property Characteristics
2nd home/investment prop	Indicator for second home or investment property, equals 1 minus "Primary residence" dummy
Multi unit	Indicator for 2-4 unit properties, equals 1 minus "Single unit" dummy
	Borrower Characteristics
FICO	Fair, Isaac and Company (FICO) credit score at origination
Debt-to-income	All monthly debt payments divided by monthly gross income in %, also referred to as back-end ratio
Risk grade	Risk category assigned to the loan based on the borrower's credit history, FICO score, LTV and debt-to-income ratio
Monthly income	Combined monthly borrower income in thousands of dollars
	Broker Variables
Broker competition	Number of brokers with loan applications in zip code divided by the number of housing units (in thousands) in zip
Active broker	Indicator for brokers with five or more loan applications submitted to New Century in previous month
	Neighborhood Characteristics
Race	% white population in zip code, based on 2000 census data
Education	% of population with a BA degree in zip code, based on 2000 census data
	Regulation Variables
Regulation (coverage)	Index of coverage of anti-predatory lending laws
Regulation (brokers, Pahl)	Pahl (2007) index of mortgage broker regulation
	Market Conditions
6mo LIBOR	6-month LIBOR rate in %
30yr fix rate - 6mo LIBOR	Spread between 30-year conventional mortgage rate and 6-month LIBOR in %
House prices	Lagged abnormal 3-year cumulative house price appreciation in % (Source: OFHEO)

Table 2: **Descriptive Statistics** The table reports descriptive statistics for our sample of broker originated loans that were funded by New Century between 1997 and 2006. Details on the sample construction are provided in Appendix A.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	All
					Broker loans funded by New Century (×1000)						
No of first liens	3	12	16	14	26	59	107	137	151	143	669
free-standing	3	12	16	14	26	58	102	113	108	104	557
piggyback	0	0	0	0	0	1	5	24	43	39	112
Loan amt of first liens	102	101	113	127	149	158	173	194	214	217	190
free-standing	102	101	113	127	149	157	172	192	208	209	183
piggyback (total)	0	126	0	175	199	206	232	258	288	296	281
No of brokers	1	3	4	4	5	9	15	21	25	26	56
					Location (percent)						
CA	28	18	19	27	33	30	30	30	27	21	27
FL	5	8	9	10	8	9	9	9	12	12	10
TX	4	4	7	7	4	5	6	6	5	8	6
West w/o CA	22	15	13	13	12	11	10	14	14	12	13
South w/o FL, TX	4	14	15	13	12	12	11	11	11	14	12
Midwest	35	32	26	23	25	23	19	16	15	17	18
Northeast	3	8	12	7	7	10	14	15	16	17	14
Metro areas	90	90	89	90	91	91	92	91	91	90	91
					Loan characteristics (percent)						
Refi, cash out	54	48	55	57	60	62	63	56	47	47	54
Refi, no cash out	22	16	16	16	17	17	11	6	9	9	10
2/28	61	57	62	66	78	70	65	57	41	28	51
3/27	6	4	7	17	3	3	3	3	7	4	5
30yr FRM	29	34	26	15	16	23	28	20	17	13	19
20yr FRM	0	0	1	0	0	1	1	1	1	0	1
15yr FRM	4	4	4	2	2	3	3	2	1	1	2
Ballon w/ adj rate	0	0	0	0	0	0	0	0	6	36	9
Ballon w/ fixed rate	0	0	0	0	0	0	0	0	1	4	1
Interest only	0	0	0	0	0	0	0	17	27	14	12
Prepay penalty	68	72	76	85	84	81	81	79	74	72	77
Limited or stated doc	33	38	37	38	44	44	41	47	44	41	43
Rate 30yr FRM	9.7	10.1	10.3	11.2	9.7	8.4	7.5	7.1	7.3	8.5	7.9
Rate 2/28	9.9	9.8	10.0	10.7	9.6	8.5	7.6	7.3	7.7	8.9	8.1
Margin 2/28	7.0	6.1	6.1	6.2	6.6	6.6	5.8	5.6	5.8	6.2	6.0
					Property characteristics (percent)						
Primary residence	81	78	85	90	90	91	93	92	89	87	90
Single unit	92	91	92	93	93	92	93	92	93	93	93
					Borrower characteristics (percent)						
FICO	612	612	605	587	585	594	605	620	622	614	612
piggyback	–	707	–	646	666	651	647	658	655	653	654
limited or stated doc	620	620	613	597	597	606	613	633	641	634	627
LTV	73	77	77	76	78	78	80	80	80	80	80
CLTV	74	79	79	78	79	80	82	85	86	86	84
Monthly income	5.4	5.5	5.3	5.6	5.9	5.9	6.0	6.2	6.8	7.2	6.4
Debt-to-income ratio	37	36	37	39	39	39	39	40	40	41	40

Table 3: **Broker Compensation** The table reports average per-loan broker fees, YSP and revenues. The top panel reports the statistics by origination year, whereas the bottom panel shows the statistics for loans sorted on loan amount and on origination period (1997-03, 2004-06), loan program (hybrid, fixed-rate, balloon/IO), level of documentation (full, limited/stated), FICO score (< 620, ≥ 620), and prepayment penalty (no PP, PP).

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	All	
						Percent of loan amount						
Direct fees	3.2	3.2	3.3	3.2	2.9	2.7	2.4	2.0	2.0	2.1	2.3	
YSP	1.6	1.3	1.0	1.0	0.9	1.0	0.9	1.0	0.8	0.7	0.9	
Revenue	4.9	4.4	4.4	4.2	3.8	3.7	3.3	3.0	2.8	2.8	3.1	
						Dollar per loan (×1,000)						
Direct fees	2.6	2.6	3.0	3.4	3.7	3.6	3.5	3.5	3.9	4.2	3.7	
YSP	1.6	1.2	1.1	1.1	1.1	1.4	1.5	1.8	1.7	1.4	1.6	
Revenue	4.2	3.7	4.1	4.5	4.8	5.0	5.0	5.4	5.6	5.6	5.3	
	All	'97-03	'04-06	Hybr	FRM	B/IO	Full	L/Std	<620	≥620	nPP	PP
						Dollar per loan (×$1,000)						
						Loan amount ≤ 50K						
Direct fees	1.7	1.7	1.6	1.7	1.7	1.5	1.7	1.7	1.7	1.7	1.5	1.8
YSP	0.5	0.5	0.6	0.6	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5
Revenue	2.2	2.2	2.2	2.3	2.2	1.9	2.2	2.2	2.3	2.2	2.1	2.3
						Loan amount ∈ (50,75]K						
Direct fees	2.1	2.3	1.9	2.1	2.1	1.8	2.1	2.0	2.1	2.0	1.8	2.2
YSP	0.7	0.7	0.7	0.8	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7
Revenue	2.8	3.0	2.6	2.9	2.7	2.4	2.8	2.7	2.8	2.7	2.6	2.9
						Loan amount ∈ (75,100]K						
Direct fees	2.5	2.7	2.3	2.4	2.6	2.2	2.5	2.4	2.6	2.3	2.2	2.6
YSP	0.9	0.9	0.9	1.0	0.7	0.8	0.9	0.9	0.9	0.9	1.0	0.9
Revenue	3.4	3.6	3.2	3.5	3.3	3.1	3.4	3.3	3.5	3.2	3.1	3.5
						Loan amount ∈ (100,200]K						
Direct fees	3.3	3.5	3.2	3.3	3.6	3.3	3.3	3.3	3.5	3.1	2.8	3.5
YSP	1.3	1.3	1.3	1.5	0.9	1.2	1.3	1.3	1.4	1.3	1.4	1.3
Revenue	4.7	4.8	4.6	4.8	4.4	4.5	4.7	4.6	4.8	4.4	4.2	4.8
						Loan amount ∈ (200,300]K						
Direct fees	4.7	4.6	4.7	4.5	4.9	4.9	4.7	4.6	5.0	4.4	4.1	4.9
YSP	2.0	2.0	1.9	2.3	1.3	1.7	1.9	2.0	2.0	1.9	2.1	1.9
Revenue	6.6	6.7	6.6	6.8	6.2	6.6	6.7	6.6	7.0	6.4	6.2	6.8
						Loan amount ∈ (300,500]K						
Direct fees	5.8	5.3	5.9	5.3	5.8	6.2	5.9	5.7	6.1	5.6	5.2	6.0
YSP	2.7	2.9	2.6	3.4	1.9	2.3	2.7	2.7	2.7	2.7	3.0	2.6
Revenue	8.5	8.2	8.6	8.7	7.7	8.6	8.6	8.5	8.9	8.3	8.2	8.6
						Loan amount > 500K						
Direct fees	6.5	6.0	6.5	5.7	6.6	6.7	6.5	6.5	6.6	6.4	5.4	6.8
YSP	3.3	3.3	3.3	4.2	2.4	3.0	3.2	3.3	3.2	3.3	3.8	3.0
Revenue	9.7	9.3	9.7	9.9	9.0	9.8	9.7	9.7	9.8	9.7	9.2	9.9

Table 4: **Explaining Broker Revenues and Fees** The table reports the parameter estimates for regressions of broker revenues, in dollars per loan (first and second columns) and as a percentage of the loan amount (third and fourth columns), on observable loan, property, borrower and broker characteristics. Similar results are reported for direct broker fees in columns five through eight. The benchmark set contains all full documentation no-prepay-penalty 2/28 loans between 100 and 200K taken out by a borrower with risk grade of AA or better and a FICO score between 600 and 620 to purchase a single unit primary residence, originated in CA in 2006. Our data include 668,582 loans originated between 1997 and 2006.

	Revenues (×$1,000)		Revenues (%)		Fees (×$1,000)		Fees (%)	
YSP (×$1,000)					-0.338	(0.002)		
YSP (%)							-0.274	(0.002)
Loan amt $\leq 50K$	-1.880	(0.088)	1.450	(0.009)	-1.236	(0.081)	1.521	(0.009)
Loan amt $\in (50K, 75K]$	-1.346	(0.074)	0.806	(0.006)	-0.895	(0.068)	0.894	(0.005)
Loan amt $\in (75K, 100K]$	-0.487	(0.092)	0.447	(0.005)	-0.251	(0.085)	0.481	(0.005)
Loan amt $\in (200K, 300K]$	0.602	(0.055)	-0.298	(0.004)	0.447	(0.051)	-0.370	(0.004)
Loan amt $\in (300K, 500K]$	3.684	(0.052)	-0.536	(0.005)	2.774	(0.048)	-0.649	(0.005)
Loan amt $> 500K$	6.570	(0.141)	-0.934	(0.011)	5.382	(0.130)	-0.970	(0.010)
Loan amt	0.023	(0.000)			0.016	(0.000)		
if $\leq 50K$	0.025	(0.002)			0.017	(0.002)		
if $\in (50, 75]K$	0.015	(0.001)			0.011	(0.001)		
if $\in (75, 100]K$	0.004	(0.001)			0.002	(0.001)		
if $\in (200, 300]K$	-0.003	(0.000)			-0.002	(0.000)		
if $\in (300, 500]K$	-0.013	(0.000)			-0.009	(0.000)		
if $> 500K$	-0.019	(0.000)			-0.015	(0.000)		
Constant	-0.174	(0.088)	2.084	(0.046)	2.077	(0.082)	2.983	(0.043)
R^2	0.507		0.419		0.405		0.378	

Additional control variables included but not reported

Loan and Property Characteristics: Rate - 6mo LIBOR, NC points, Rate margin for hybrids, Dummies for product types 3/27, 30yr FRM, 20yr FRM, 15yr FRM, Balloon w/ adj rate, Balloon w/ fixed rate and Interest only, Dummies for Prepay penalty, Limited or stated doc, Piggyback, Dummies for Refi with cash out and Refi with no cash out, Dummies for LTV ≤ 0.65, LTV $\in (0.65, 0.70]$, $(0.70, 0.75]$, $(0.80, 0.85]$, $(0.85, 0.90]$, $(0.90, 0.95]$ and $(0.95, 1]$, Dummies for 2nd home/investment prop and Multi units

Borrower Characteristics: Dummies for FICO $\in [500, 525)$, $[525, 550)$, $[550, 575)$, $[575, 600)$, $[620, 640)$, $[640, 660)$, $[660, 680)$, $[680, 700)$, ≥ 700, Back-end ratio, Dummies for risk grades A+, A-, B and C

Broker Variables: Broker competition, Active broker

Neighborhood and Regulation Variables: Race, Education, Regulation (coverage), Regulation (broker, Pahl)

Market Conditions: 6mo LIBOR, 30yr fix rate - 6mo LIBOR, House prices

Year and Location Dummies: Dummies for 1997 through 2005, Dummies for FL, TX, West w/o CA, South w/o FL and TX, MidWest, NorthEast and Non-metro area

Table 5: **Broker Compensation and Loan Performance** The table reports the parameter estimates for the proportional odds duration model, with default being defined as 60-day delinquency or worse. Standard errors are shown in parentheses. The benchmark set contains all full documentation no-prepay-penalty 2/28 loans between 100 and 200K taken out by a borrower with risk grade of AA or better and a FICO score between 600 and 620 to purchase a single unit primary residence, originated in CA in 2006. Our data include 615,384 loans originated between 1999 and 2006.

	Est	Std dev	Est	Std dev	Est	Std dev	Est	Std dev
				Broker Compensation				
Revenue/loan amt (%)			0.062	(0.005)				
Fees/loan amt (%)					0.073	(0.005)		
full doc & FICO < 600							0.060	(0.007)
full doc & FICO $\in [600, 620)$							0.097	(0.015)
full doc & FICO $\in [620, 660)$							0.092	(0.014)
full doc & FICO > 660							0.143	(0.021)
low doc & FICO < 600							0.043	(0.009)
low doc & FICO $\in [600, 620)$							0.094	(0.016)
low doc & FICO $\in [620, 660)$							0.119	(0.013)
low doc & FICO > 660							0.170	(0.017)
YSP/loan amt (%)					-0.002	(0.011)	0.000	(0.011)
				Loan and Property Characteristics				
Rate-6mo LIBOR	0.325	(0.009)	0.299	(0.009)	0.336	(0.011)	0.334	(0.011)
NC points	0.019	(0.014)	0.025	(0.014)	0.033	(0.014)	0.031	(0.014)
Rate margin for hybrids	-0.080	(0.019)	-0.078	(0.019)	-0.083	(0.019)	-0.084	(0.019)
Loan amt $\leq 50K$	-0.001	(0.038)	-0.089	(0.039)	-0.115	(0.039)	-0.109	(0.039)
Loan amt $\in (50K, 75K]$	0.073	(0.022)	0.026	(0.023)	0.009	(0.023)	0.012	(0.023)
Loan amt $\in (75K, 100K]$	0.020	(0.021)	-0.007	(0.021)	-0.014	(0.021)	-0.014	(0.021)
Loan amt $\in (200K, 300K]$	0.149	(0.020)	0.166	(0.020)	0.175	(0.020)	0.178	(0.020)
Loan amt $\in (300K, 500K]$	0.399	(0.023)	0.428	(0.024)	0.444	(0.024)	0.452	(0.024)
Loan amt $> 500K$	0.741	(0.046)	0.794	(0.046)	0.806	(0.046)	0.834	(0.047)
3/27	0.039	(0.026)	0.046	(0.026)	0.042	(0.026)	0.043	(0.026)
30yr FRM	-0.805	(0.113)	-0.765	(0.114)	-0.835	(0.114)	-0.832	(0.114)
20yr FRM	-0.990	(0.149)	-0.961	(0.149)	-1.036	(0.149)	-1.038	(0.149)
15yr FRM	-1.093	(0.133)	-1.059	(0.133)	-1.129	(0.133)	-1.130	(0.133)
Balloon w/ adjustable rate	0.075	(0.026)	0.077	(0.026)	0.061	(0.026)	0.061	(0.026)
Balloon w/ fixed rate	-0.481	(0.131)	-0.446	(0.131)	-0.522	(0.132)	-0.522	(0.131)
Interest only	-0.131	(0.024)	-0.119	(0.024)	-0.132	(0.024)	-0.121	(0.024)
Prepay penalty	0.136	(0.017)	0.110	(0.017)	0.119	(0.017)	0.116	(0.017)
Limited or stated doc	0.326	(0.016)	0.353	(0.016)	0.316	(0.017)	0.336	(0.028)
Piggyback	0.627	(0.027)	0.650	(0.028)	0.644	(0.028)	0.667	(0.028)
Refi w/ cash out	-0.401	(0.016)	-0.425	(0.017)	-0.435	(0.017)	-0.433	(0.017)
Refi w/o cash out	-0.245	(0.023)	-0.255	(0.023)	-0.261	(0.023)	-0.260	(0.023)
LTV ≤ 0.65	-0.397	(0.031)	-0.424	(0.031)	-0.405	(0.031)	-0.398	(0.031)
LTV $\in (0.65, 0.70]$	-0.192	(0.032)	-0.212	(0.032)	-0.201	(0.032)	-0.195	(0.032)
LTV $\in (0.70, 0.75]$	-0.111	(0.026)	-0.122	(0.026)	-0.117	(0.026)	-0.115	(0.026)
LTV $\in (0.80, 0.85]$	0.111	(0.021)	0.122	(0.021)	0.109	(0.021)	0.106	(0.021)
LTV $\in (0.85, 0.90]$	0.183	(0.023)	0.207	(0.023)	0.182	(0.023)	0.182	(0.023)
LTV $\in (0.90, 0.95]$	0.067	(0.037)	0.100	(0.037)	0.060	(0.038)	0.069	(0.038)
LTV $\in (0.95, 1]$	0.204	(0.064)	0.252	(0.064)	0.180	(0.065)	0.195	(0.065)
2nd home/investment prop	0.010	(0.023)	0.022	(0.023)	-0.008	(0.024)	-0.006	(0.024)

Continued on next page

Table 5 – continued from previous page

	Est	Std dev	Est	Std dev	Est	Std dev	Est	Std dev
Multi units	0.009	(0.027)	0.010	(0.027)	0.007	(0.027)	0.007	(0.027)
Borrower Characteristics								
FICO $\in [500, 525)$	0.719	(0.030)	0.740	(0.030)	0.692	(0.031)	0.807	(0.046)
FICO $\in [525, 550)$	0.611	(0.028)	0.626	(0.028)	0.593	(0.029)	0.706	(0.044)
FICO $\in [550, 575)$	0.432	(0.027)	0.439	(0.027)	0.419	(0.027)	0.530	(0.042)
FICO $\in [575, 600)$	0.239	(0.025)	0.243	(0.025)	0.231	(0.025)	0.331	(0.040)
FICO $\in [620, 640)$	-0.175	(0.027)	-0.177	(0.027)	-0.172	(0.027)	-0.200	(0.045)
FICO $\in [640, 660)$	-0.400	(0.030)	-0.404	(0.030)	-0.394	(0.030)	-0.427	(0.046)
FICO $\in [660, 680)$	-0.618	(0.035)	-0.623	(0.035)	-0.610	(0.035)	-0.738	(0.054)
FICO $\in [680, 700)$	-0.815	(0.044)	-0.823	(0.044)	-0.804	(0.044)	-0.931	(0.060)
FICO ≥ 700	-0.997	(0.041)	-1.005	(0.041)	-0.988	(0.041)	-1.115	(0.057)
Debt-to-income ratio	0.006	(0.001)	0.006	(0.001)	0.006	(0.001)	0.006	(0.001)
Risk grade A+	0.176	(0.021)	0.187	(0.021)	0.174	(0.021)	0.169	(0.022)
Risk grade A-	0.215	(0.025)	0.228	(0.025)	0.209	(0.025)	0.210	(0.025)
Risk grade B	0.506	(0.028)	0.523	(0.028)	0.493	(0.029)	0.496	(0.029)
Risk grade C	0.728	(0.035)	0.762	(0.035)	0.703	(0.036)	0.711	(0.036)
Broker Variables								
Broker competition	0.002	(0.002)	0.002	(0.002)	0.001	(0.002)	0.002	(0.002)
Active broker	0.033	(0.014)	0.014	(0.014)	0.012	(0.014)	0.012	(0.014)
Neighborhood and Regulation Variables								
Race	-0.003	(0.000)	-0.002	(0.000)	-0.002	(0.000)	-0.002	(0.000)
Education	-0.009	(0.001)	-0.008	(0.001)	-0.007	(0.001)	-0.007	(0.001)
Regulation (coverage)	-0.005	(0.003)	-0.003	(0.003)	-0.001	(0.003)	-0.001	(0.003)
Regulation (brokers, Pahl)	-0.012	(0.003)	-0.011	(0.003)	-0.011	(0.003)	-0.011	(0.003)
Market Conditions								
6mo LIBOR	0.345	(0.027)	0.331	(0.027)	0.360	(0.027)	0.359	(0.027)
30yr fix mortg rate-6mo LIBOR	0.029	(0.028)	0.033	(0.028)	0.036	(0.028)	0.037	(0.028)
House prices	-0.011	(0.002)	-0.012	(0.002)	-0.012	(0.002)	-0.012	(0.002)
Year and Location Dummies								
1999	-0.939	(0.045)	-0.971	(0.046)	-0.993	(0.046)	-0.989	(0.046)
2000	-1.102	(0.059)	-1.127	(0.059)	-1.162	(0.059)	-1.152	(0.059)
2001	-0.515	(0.047)	-0.517	(0.047)	-0.550	(0.048)	-0.543	(0.048)
2002	-0.524	(0.065)	-0.533	(0.064)	-0.544	(0.065)	-0.540	(0.065)
2003	-0.452	(0.063)	-0.462	(0.063)	-0.455	(0.063)	-0.452	(0.063)
2004	-0.250	(0.052)	-0.270	(0.052)	-0.244	(0.052)	-0.243	(0.052)
2005	-0.032	(0.031)	-0.054	(0.031)	-0.027	(0.031)	-0.027	(0.031)
FL	-0.064	(0.035)	-0.068	(0.035)	-0.060	(0.035)	-0.058	(0.035)
TX	0.076	(0.039)	0.069	(0.039)	0.088	(0.039)	0.084	(0.039)
WestnoCA	0.119	(0.030)	0.127	(0.030)	0.137	(0.030)	0.137	(0.030)
SouthnoFLTX	0.288	(0.029)	0.279	(0.029)	0.283	(0.029)	0.281	(0.029)
MidWest	0.303	(0.028)	0.293	(0.029)	0.299	(0.029)	0.299	(0.029)
NorthEast	0.217	(0.026)	0.205	(0.027)	0.212	(0.027)	0.211	(0.027)
Nonmetro area	-0.002	(0.022)	-0.005	(0.022)	-0.006	(0.022)	-0.005	(0.022)

Table 6: **Marginal Effect of Broker Fees on Loan Performance** The table shows the increase in the log proportional odds ratio associated with a one standard deviation increase in percentage broker fees, based on the estimates in the last two columns of Table 5. Standard deviations are computed conditional on loan amount, FICO score and documentation level. Our data include 615,384 loans originated between 1999 and 2006.

	Loan amount (×$1,000)							
	≤ 50	$(50, 75]$	$(75, 100]$	$(100, 200]$	$(200, 300]$	$(300, 500]$	> 500	All
FICO	*Full documentation*							
< 600	0.113	0.089	0.081	0.072	0.064	0.058	0.042	0.084
$[600, 620)$	0.194	0.142	0.123	0.109	0.097	0.090	0.064	0.124
$[620, 660)$	0.177	0.138	0.120	0.104	0.093	0.083	0.064	0.117
≥ 660	0.299	0.224	0.184	0.163	0.144	0.127	0.098	0.183
FICO	*Limited or stated documentation*							
< 600	0.078	0.065	0.060	0.053	0.047	0.041	0.031	0.059
$[600, 620)$	0.184	0.136	0.123	0.110	0.097	0.088	0.066	0.121
$[620, 660)$	0.227	0.173	0.151	0.132	0.117	0.102	0.079	0.142
≥ 660	0.324	0.246	0.214	0.180	0.160	0.140	0.109	0.190

Table 7: **Proposed QRM Criteria** The table summarizes the qualified residential mortgage requirements, as proposed by the Agencies in March 2011. In addition to the main criteria listed below, certain assumability prohibitions and default mitigations commitments apply. For details, see Agencies (2011).

Rule	Reference name	Description
1	Eligible loans	First liens on a one-to-four family residential property Home purchased or refinanced has to be the principal residence Piggyback loans are prohibited for purchases, maturity $\leq$ 30 years
2	Borrower credit history	Borrower is not currently $\geq$ 30 days past due on any debt, has not been $\geq$ 60 days late within the past 2 years Borrower has not been a debtor in a bankruptcy proceeding, has not had property repossessed or foreclosed upon, did not engaged in a short sale or deed-in-lieu of foreclosure, and has not been subject to a Federal or State judgment for collection of any unpaid debt in the past 3 years
3	Payment terms	Balloon or interest-only payments, or negative amortization, not allowed Regular P&I payments may not result in increase of unpaid principal, do not allow borrower to defer payment of interest or repayment of principal Increases in rates after closing of adjustable-rate loans may not exceed 2% in any 12-month period, or 6% over the life of the mortgage transaction Prepayment penalties are not permitted
4	Loan-to-value ratio	LTV $\leq$ 80% for purchases CLTV $\leq$ 75% for no-cash-out refinance mortgages CLTV $\leq$ 70% for cash-out refinance mortgages
5	Down payment	Financing of closing costs is not permitted For purchases, the minimum cash down payments are closing costs, plus 0.2 $\times$ min(appraisal value, purchase price), plus max(purchase price-appraisal value, 0) Funds used by the borrower must come from certain acceptable sources
6	Qualifying appraisal	Written appraisals conforming to generally accepted appraisal standards are required
7	Ability to repay	Borrower's front-end ratio (mortgage payment/gross income) $\leq$ 28% Borrower's back-end ratio (all debt payments/gross income) $\leq$ 36% Full documentation of monthly gross income, housing debt and total debt
8	Origination charges	Origination charges paid by borrower $\leq$ 3% of the loan amount Charges include (i) compensation paid directly or indirectly to originator (ii) finance charges (12 CFR section 226.4(a)(b), except 226.4(b)(1)) (iii) real-estate related fees (12 CFR section 226.4(c)(7)), unless reasonable (iv) credit insurance premia, debt cancellation or suspension fees (v) prepayment penalties on a previous loan with the same lender

Table 8: **Broker Costs and Profits** The table reports average marginal broker costs and profits per loan, for different cost specifications in Equation (11). The top panel conditions on the year of origination, whereas the bottom panel conditions on the loan amount (in $1,000). Our data include 668,582 loans originated between 1997 and 2006.

w	0	0.25	0.5	0.75	1	0	0.25	0.5	0.75
				By origination year					
		Costs (×$1,000)				*Profits (×$1,000)*			
1997	1.775	2.388	3.002	3.615	4.229	2.454	1.840	1.227	0.613
1998	1.453	2.023	2.592	3.161	3.730	2.277	1.708	1.139	0.569
1999	1.596	2.219	2.841	3.463	4.085	2.489	1.867	1.245	0.622
2000	1.841	2.518	3.194	3.870	4.546	2.705	2.029	1.352	0.676
2001	2.018	2.723	3.428	4.133	4.838	2.819	2.114	1.410	0.705
2002	2.197	2.898	3.599	4.299	5.000	2.804	2.103	1.402	0.701
2003	2.223	2.929	3.635	4.341	5.047	2.824	2.118	1.412	0.706
2004	2.295	3.071	3.847	4.624	5.400	3.105	2.329	1.553	0.776
2005	2.384	3.207	4.031	4.854	5.678	3.294	2.470	1.647	0.823
2006	2.330	3.169	4.007	4.845	5.684	3.353	2.515	1.677	0.838
All	2.248	3.017	3.787	4.556	5.326	3.078	2.308	1.539	0.769
		Percentage costs				*Percentage profits*			
1997	2.013	2.737	3.461	4.186	4.910	2.897	2.172	1.448	0.724
1998	1.546	2.277	3.008	3.739	4.470	2.924	2.193	1.462	0.731
1999	1.591	2.289	2.987	3.685	4.383	2.792	2.094	1.396	0.698
2000	1.700	2.334	2.968	3.602	4.237	2.537	1.903	1.268	0.634
2001	1.584	2.140	2.695	3.251	3.806	2.223	1.667	1.111	0.556
2002	1.634	2.145	2.656	3.168	3.679	2.045	1.534	1.023	0.511
2003	1.484	1.937	2.390	2.843	3.296	1.812	1.359	0.906	0.453
2004	1.339	1.762	2.185	2.608	3.031	1.692	1.269	0.846	0.423
2005	1.270	1.668	2.066	2.463	2.861	1.591	1.193	0.795	0.398
2006	1.256	1.642	2.029	2.415	2.802	1.546	1.160	0.773	0.387
All	1.384	1.829	2.274	2.720	3.165	1.780	1.335	0.890	0.445
				By loan amount (×$1,000)					
		Costs (×$1,000)				*Profits (×$1,000)*			
≤ 50	0.828	1.182	1.536	1.889	2.243	1.415	1.061	0.707	0.354
(50,75]	1.271	1.655	2.039	2.423	2.807	1.536	1.152	0.768	0.384
(75,100]	1.577	2.034	2.492	2.950	3.408	1.831	1.373	0.915	0.458
(100,200]	2.148	2.782	3.416	4.051	4.685	2.537	1.903	1.269	0.634
(200,300]	2.835	3.800	4.764	5.729	6.693	3.858	2.894	1.929	0.965
(300,500]	3.243	4.575	5.908	7.240	8.573	5.330	3.997	2.665	1.332
>500	2.528	4.338	6.148	7.958	9.768	7.240	5.430	3.620	1.810
		Percentage costs				*Percentage profits*			
≤ 50	1.968	2.849	3.731	4.612	5.493	3.525	2.644	1.762	0.881
(50,75]	2.006	2.615	3.225	3.834	4.443	2.437	1.827	1.218	0.609
(75,100]	1.753	2.263	2.773	3.283	3.794	2.041	1.531	1.020	0.510
(100,200]	1.449	1.873	2.297	2.721	3.145	1.697	1.272	0.848	0.424
(200,300]	1.116	1.493	1.871	2.249	2.627	1.511	1.133	0.755	0.378
(300,500]	0.836	1.174	1.512	1.851	2.189	1.353	1.015	0.677	0.338
>500	0.417	0.707	0.998	1.288	1.578	1.161	0.871	0.581	0.290

Table 9: **Broker Costs and Profits for Different Loan Types** The table reports average marginal broker costs per loan for different types of loans and different cost specifications in Equation (11), conditional on the size of the loan. Columns labeled "prft^0" report average marginal broker profits per loan for the perfect rent extraction case. Costs and profits are shown in $1,000. Our data include 668,582 loans originated between 1997 and 2006.

	Loan amt $\leq$ 100K			Loan amt 100-300K			Loan amt $>$ 300K		
	c^0	c^1	prft^0	c^0	c^1	prft^0	c^0	c^1	prft^0
Loan and property characteristics									
2/28	1.455	3.132	1.677	2.476	5.491	3.015	3.326	8.863	5.536
3/27	1.340	2.973	1.633	2.302	5.138	2.836	3.153	8.661	5.508
30yr FRM	1.191	2.859	1.668	2.213	4.996	2.783	3.060	7.883	4.823
20yr FRM	1.321	2.993	1.673	2.202	4.829	2.626	3.224	8.028	4.803
15yr FRM	1.214	2.756	1.542	2.155	4.722	2.566	3.119	7.781	4.661
Balloon w/ adj rate	1.424	2.861	1.437	2.495	5.662	3.167	3.237	9.150	5.913
Balloon w/ fixed rate	1.329	2.642	1.313	2.335	5.448	3.112	3.132	9.271	6.139
Interest only	1.159	2.932	1.774	2.246	5.477	3.231	2.949	8.629	5.680
No prepay penalty	1.174	2.730	1.555	2.162	4.993	2.831	2.953	8.391	5.439
Prepay penalty	1.417	3.109	1.692	2.450	5.495	3.045	3.225	8.819	5.594
Full documentation	1.411	3.032	1.621	2.416	5.322	2.906	3.228	8.742	5.513
Limited or stated doc	1.240	2.970	1.730	2.352	5.474	3.122	3.107	8.694	5.587
Stand-alone first lien	1.346	3.006	1.660	2.420	5.436	3.016	3.181	8.675	5.494
Piggyback	1.459	3.075	1.617	2.251	5.179	2.928	3.085	8.836	5.751
Purchase	1.181	2.810	1.629	2.136	4.988	2.852	2.955	8.469	5.514
Refi, cash out	1.485	3.129	1.644	2.590	5.718	3.128	3.338	8.953	5.615
Refi, no cash out	1.274	3.067	1.794	2.193	5.021	2.828	3.047	8.423	5.375
Primary residence	1.431	3.064	1.633	2.426	5.442	3.016	3.184	8.762	5.579
2nd home/investment property	0.960	2.741	1.782	1.986	4.816	2.830	2.839	8.112	5.273
One unit	1.355	3.014	1.659	2.367	5.352	2.985	3.133	8.604	5.471
Multi units	1.357	2.965	1.608	2.684	5.898	3.214	3.334	9.495	6.161
Borrower characteristics									
FICO $<$ 600	1.469	3.090	1.621	2.542	5.591	3.049	3.442	9.075	5.634
FICO $\in [600, 620)$	1.388	3.006	1.618	2.426	5.359	2.933	3.252	8.852	5.600
FICO $\in [620, 660)$	1.254	2.938	1.684	2.319	5.262	2.943	3.133	8.631	5.497
FICO $\geq$ 660	1.008	2.802	1.794	2.132	5.140	3.008	2.923	8.453	5.530
AAA or AA	1.339	2.932	1.593	2.318	5.268	2.950	3.092	8.657	5.564
A+	1.274	3.019	1.744	2.431	5.426	2.995	3.284	8.689	5.405
A−	1.418	3.123	1.705	2.522	5.588	3.066	3.398	9.029	5.632
B	1.482	3.177	1.695	2.633	5.823	3.191	3.556	9.268	5.712
C	1.388	3.034	1.647	2.567	5.917	3.350	3.411	9.505	6.094
Neighborhood and regulation variables									
Race, $\leq$ 75% white	1.431	3.033	1.602	2.568	5.757	3.190	3.271	9.016	5.745
Race, $>$ 75% white	1.279	2.990	1.711	2.221	5.043	2.822	2.990	8.266	5.276
Education, $\leq$ 12.5% w/ BA	1.389	2.993	1.604	2.478	5.490	3.012	3.344	9.026	5.682
Education, $>$12.5% w/ BA	1.283	3.049	1.766	2.306	5.294	2.989	3.065	8.557	5.493
Baseline anti-predatory regulation	1.327	3.106	1.779	2.249	5.161	2.912	3.082	8.413	5.331
Stricter state anti-pred regulation	1.405	2.838	1.433	2.509	5.585	3.076	3.179	8.795	5.616
Broker variables									
Low broker competition	1.315	2.987	1.671	2.273	5.115	2.842	3.082	8.621	5.539
High broker competition	1.317	2.887	1.570	2.300	4.946	2.646	3.137	8.433	5.296
Active broker	1.628	3.259	1.631	2.636	5.890	3.254	3.365	9.261	5.896
Inactive broker	1.248	2.914	1.667	2.261	5.129	2.869	3.049	8.425	5.376
Location									
Metro area	1.362	3.035	1.674	2.396	5.424	3.029	3.159	8.726	5.567
Non-metro area	1.317	2.887	1.570	2.300	4.946	2.646	3.137	8.433	5.296

Table 10: **Descriptive Statistics for QRM and Non-QRM Loans** For each proposed QRM Rule, the table reports average loan, borrower, broker and neighborhood characteristics, for the set of loans that satisfy a particular rule (first row), and the group of loans that do not (second row). The first row for restriction QRM8 (c^w) refers to the set of loans for which broker costs c^w defined in Equation (11) do not exceed 3% of the loan amount, whereas the second row refers to loans for which percentage costs exceed 3%. The last four columns show 12-month delinquency rates for loans originated in 2003, 2004, 2005 and between 1999 and 2005, respectively.

Restr		Loan characteristics						Borrower		Broker		Neighborhood			Delinquency rates			
	% loans	Size	Hybr	FRM	Refi	LTV	CLTV	FICO	Inco	Comp	Active	Race	Educ	Inco	2003	2004	2005	'99-05
None	100.0	190	55.3	22.2	63.9	79.6	83.8	612	6.4	0.66	0.33	67.1	14.1	3.8	8.7	10.2	12.8	13.3
QRM8 (c^0)	97.5	193	55.0	22.0	63.2	79.7	84.0	613	6.5	0.66	0.32	67.5	14.3	3.8	8.4	9.9	12.5	13.1
	2.5	58	68.6	29.8	87.8	73.3	74.6	567	3.3	0.41	0.53	49.5	8.5	2.7	21.1	24.4	29.4	24.7
QRM8 ($c^{0.25}$)	92.3	199	54.1	21.8	62.2	80.0	84.4	615	6.7	0.68	0.31	67.9	14.5	3.9	7.9	9.5	12.0	12.6
	7.7	71	70.1	27.8	83.3	75.0	76.4	573	3.6	0.41	0.46	57.5	9.8	3.0	19.0	22.2	27.8	22.6
QRM8 ($c^{0.5}$)	79.8	213	52.3	21.0	59.9	80.4	85.2	619	7.0	0.70	0.31	68.2	14.9	3.9	7.1	8.8	11.4	11.9
	20.2	97	67.1	27.2	79.6	76.3	77.9	582	4.2	0.48	0.40	62.7	11.2	3.2	15.2	17.5	21.5	19.3
QRM8 ($c^{0.75}$)	64.8	227	50.5	20.1	57.2	80.8	86.2	623	7.3	0.72	0.29	68.6	15.2	4.0	6.4	8.2	10.9	11.4
	35.2	121	64.2	26.1	76.1	77.4	79.3	590	4.7	0.53	0.38	64.3	12.1	3.4	12.7	14.8	18.0	17.1
QRM8 (c^1)	51.9	236	48.9	19.7	55.4	80.9	86.7	626	7.6	0.74	0.29	68.9	15.5	4.1	5.8	7.8	10.5	11.0
	48.1	140	62.2	24.9	73.0	78.2	80.5	596	5.2	0.56	0.37	65.1	12.6	3.5	11.7	13.3	16.3	16.0
QRM1	71.1	190	56.7	25.9	82.0	79.1	79.9	600	5.8	0.62	0.35	67.9	14.3	3.9	8.3	10.0	12.2	12.4
	29.0	189	51.8	13.2	19.4	80.6	93.1	641	7.8	0.74	0.27	65.0	13.8	3.7	10.8	10.6	13.8	15.3
QRM2	78.5	199	51.5	22.4	55.8	80.7	86.1	624	6.7	0.70	0.33	67.0	14.1	3.8	6.7	8.7	11.3	11.6
	21.5	180	64.4	20.1	91.1	76.3	77.0	571	5.8	0.62	0.37	67.2	14.0	3.8	15.7	16.9	20.0	20.0
QRM3	4.8	123	2.0	98.0	85.7	75.9	77.2	604	5.4	0.39	0.33	65.8	14.2	3.6	6.4	9.8	10.6	10.9
	95.2	193	58.0	18.4	62.8	79.8	84.1	612	6.5	0.67	0.33	67.2	14.1	3.8	8.9	10.2	12.8	13.4
QRM4	37.0	188	47.7	22.7	42.3	70.6	79.7	620	6.5	0.72	0.32	67.0	14.6	3.9	8.0	9.4	11.7	12.8
	63.0	190	59.8	21.9	76.6	84.9	86.1	607	6.4	0.62	0.33	67.1	13.9	3.7	8.9	10.7	13.6	13.6
QRM5	30.4	203	41.9	31.3	71.7	79.1	82.3	615	6.4	0.68	0.36	63.9	13.6	3.8	6.4	8.4	11.5	11.8
	69.6	184	61.2	18.3	60.4	79.8	84.4	610	6.4	0.64	0.31	68.5	14.4	3.8	9.8	10.8	13.2	14.0
QRM7	13.8	142	55.1	31.2	73.3	78.6	81.4	600	7.0	0.56	0.32	69.3	13.6	3.7	7.1	9.1	10.7	10.7
	86.2	197	55.4	20.7	62.0	79.9	84.4	614	6.4	0.67	0.33	66.8	14.2	3.8	8.9	10.3	13.0	13.7

Table 11: **Delinquency Rates under QRM Rules** In the top panel, the first column shows the distribution of loans across different size bins and the second column reports the average 12-month delinquency rates for each size bin. For each size bin, the third column shows the percentage of loans in that size bin that satisfy QRM Rule 8 in the perfect rent extraction case (w=0 in Equation (11)), and the fourth column reports the average 12-month delinquency rate of those loans. Columns 5 through 12 report similar statistics after replacing $w = 0$ by $w = 0.25, 0.5, 0.75, 1$. The middle panel recomputes the statistics from the top panel after replacing QRM Rule 8 by the alternative specification described in Section 8.3. Small discrepancies between the top and middle panel for 100-200K loans are due to the fact that size bins are formed on the loan amount of the first lien whereas limits on origination charges for piggybacks are computed as a function of the total loan amount. For each size bin, the bottom panel shows the percentage of loans in that size bin that satisfy certain other QRM rules, together with their average 12-month delinquency rates.

	Full sample		QRM8 (c^0)		QRM8 $(c^{0.25})$		QRM8 $(c^{0.5})$		QRM8 $(c^{0.75})$		QRM8 (c^1)	
size bin	loans	delq	in bin	delq	in bin	delq	in bin	delq	in bin	delq	in bin	delq
(0,50]	3.4	17.0	77.4	15.9	56.7	14.3	30.0	13.1	14.9	11.9	9.6	12.6
(50,75]	10.6	19.0	86.8	18.0	67.4	16.4	43.3	15.1	27.6	15.3	19.2	16.1
(75,100]	12.0	15.1	97.4	14.9	85.5	14.1	62.6	13.0	43.6	12.7	31.9	12.7
(100,200]	37.2	12.4	99.9	12.3	97.3	12.1	83.0	11.5	64.4	10.9	49.8	10.5
(200,300]	20.0	11.4	100.0	11.4	100.0	11.4	95.7	11.1	82.1	10.6	66.6	10.2
(300,500]	14.7	11.8	100.0	11.8	100.0	11.8	99.5	11.8	93.3	11.5	80.3	10.9
>500	2.0	13.8	100.0	13.8	100.0	13.8	100.0	13.8	100.0	13.8	98.0	13.8
All	100.0	13.3	97.5	13.1	92.3	12.6	79.8	11.9	64.8	11.4	51.9	11.0

Alternative specification of QRM Rule 8

	c^0		$c^{0.25}$		$c^{0.5}$		$^{0.75}$		c^1	
size bin	in bin	delq	in bin	delq	in bin	delq	in bin	delq	in bin	delq
(0,50]	77.4	15.9	56.7	14.3	30.0	13.1	14.9	11.9	9.6	12.6
(50,75]	86.8	18.0	67.4	16.4	43.3	15.1	27.6	15.3	19.3	16.1
(75,100]	97.4	14.9	85.5	14.1	62.6	13.0	43.6	12.7	31.9	12.7
(100,200]	99.9	12.3	97.3	12.1	83.0	11.5	64.3	10.9	49.6	10.5
(200,300]	100.0	11.4	99.9	11.4	92.9	10.9	75.7	10.4	60.0	9.9
(300,500]	100.0	11.8	100.0	11.8	93.7	11.3	74.1	10.2	57.6	10.0
>500	100.0	13.8	100.0	13.8	98.7	13.7	72.8	11.8	52.2	11.2
All	97.5	13.1	92.3	12.6	78.4	11.8	60.1	11.0	46.2	10.7

Other QRM Rules

	QRM1		QRM2		QRM3		QRM4		QRM5		QRM7	
size bin	in bin	delq	in bin	delq	in bin	delq	in bin	delq	in bin	delq	in bin	delq
(0,50]	66.5	16.5	46.0	15.6	18.6	14.5	54.3	17.6	25.5	13.4	27.5	15.7
(50,75]	68.2	17.7	64.6	19.0	10.4	14.8	32.5	17.6	26.4	16.4	23.4	15.8
(75,100]	70.6	14.0	68.8	14.4	7.7	9.5	36.4	13.5	27.1	13.0	19.8	12.2
(100,200]	72.4	11.8	71.4	10.6	3.9	9.4	37.4	11.3	29.2	10.9	13.9	8.9
(200,300]	72.6	10.7	75.6	9.4	2.4	5.6	37.0	11.0	33.1	10.5	8.2	6.9
(300,500]	69.7	10.5	80.3	10.2	1.6	6.3	35.7	13.2	35.4	11.4	5.8	5.6
>500	65.7	9.5	84.0	13.4	0.9	5.1	37.5	19.3	39.3	11.6	6.0	8.6
All	71.0	12.4	71.9	11.6	4.8	10.9	37.0	12.8	30.4	11.8	13.6	10.7

Table 12: **Profit Contraction under QRM Rules** For different measures of broker costs, the top panel reports the percentage of loans in our sample with broker costs of 3% or less (columns labeled "%"), the average broker profits for these loans in $1,000 (columns labeled "No cap"), and the average broker profits for these loans in $1,000 if origination charges are capped at 3% (columns labeled "Cap"). The second set of rows shows the fraction of loans in our sample with broker costs of 3% or less that satisfy an additional QRM rule, the average broker profits for these loans, and the average broker profits for these loans if origination charges are capped at 3%. Results in the bottom panel replicate those in the top panel after replacing the 3% cap proposed in QRM Rule 8 by the alternative specification of QRM Rule 8 described in Section 8.3.

	%	No cap	Cap	%	No cap	Cap	%	No cap	Cap	%	No cap	Cap
Size	QRM8 (c^0)			QRM8 ($c^{0.25}$)			QRM8 ($c^{0.5}$)			QRM8 ($c^{0.75}$)		
(0,50]	2.6	1.569	0.609	1.9	1.104	0.369	1.0	0.560	0.220	0.5	0.178	0.117
(50,75]	9.2	1.588	0.689	7.1	1.070	0.444	4.6	0.554	0.285	2.9	0.202	0.145
(75,100]	11.7	1.834	0.969	10.3	1.259	0.622	7.5	0.680	0.394	5.2	0.263	0.199
(100,200]	37.2	2.538	1.753	36.2	1.858	1.157	30.9	1.082	0.710	24.0	0.444	0.351
(200,300]	20.0	3.858	3.170	20.0	2.892	2.206	19.2	1.815	1.329	16.5	0.773	0.635
(300,500]	14.7	5.330	4.914	14.7	3.997	3.582	14.7	2.646	2.263	13.8	1.232	1.080
>500	2.0	7.240	7.222	2.0	5.430	5.412	2.0	3.620	3.602	2.0	1.810	1.792
All	97.5	3.127	2.408	92.3	2.357	1.732	79.8	1.533	1.155	64.8	0.709	0.598
	Interaction of QRM Rule 8 with other QRM rules											
QRM		c^0			$c^{0.25}$			$c^{0.5}$			$c^{0.75}$	
1 & 8	68.9	3.158	2.337	64.8	2.382	1.663	54.8	1.536	1.102	43.1	0.694	0.570
2 & 8	70.6	3.163	2.544	67.9	2.386	1.833	60.4	1.563	1.213	50.3	0.729	0.624
3 & 8	4.6	2.242	1.614	4.3	1.701	1.145	3.5	1.095	0.777	2.6	0.504	0.416
4 & 8	36.9	3.054	2.405	36.4	2.294	1.666	35.1	1.525	0.945	33.1	0.748	0.223
5 & 8	30.3	2.646	2.193	29.8	1.988	1.558	27.4	1.286	1.008	23.5	0.586	0.506
7 & 8	13.0	2.518	1.705	11.8	1.881	1.212	9.4	1.181	0.821	7.2	0.529	0.433
	Alternative specification of QRM Rule 8											
Size	QRM8alt (c^0)			QRM8alt ($c^{0.25}$)			QRM8alt ($c^{0.5}$)			QRM8alt ($c^{0.75}$)		
(0,50]	2.6	1.569	0.609	1.9	1.104	0.369	1.0	0.560	0.220	0.5	0.178	0.117
(50,75]	9.2	1.588	0.689	7.1	1.070	0.444	4.6	0.554	0.285	2.9	0.202	0.145
(75,100]	11.7	1.834	0.969	10.3	1.259	0.622	7.5	0.680	0.394	5.2	0.263	0.199
(100,200]	37.2	2.538	1.750	36.2	1.858	1.154	30.9	1.081	0.707	23.9	0.443	0.349
(200,300]	20.0	3.858	2.973	20.0	2.889	2.011	18.6	1.744	1.183	15.2	0.708	0.564
(300,500]	14.7	5.330	4.104	14.7	3.997	2.772	13.8	2.454	1.586	10.9	0.958	0.768
>500	2.0	7.240	5.722	2.0	5.430	3.912	2.0	3.578	2.132	1.4	1.369	1.003
All	97.5	3.127	2.213	92.3	2.357	1.527	78.4	1.466	0.949	60.1	0.596	0.470
	Interaction of alternative QRM Rule 8 with other QRM rules											
QRM		c^0			$c^{0.25}$			$c^{0.5}$			$c^{0.75}$	
1 & 8alt	68.9	3.158	2.149	64.8	2.381	1.464	53.6	1.457	0.904	39.8	0.580	0.449
2 & 8alt	70.6	3.163	2.333	67.9	2.385	1.614	59.4	1.500	0.996	46.7	0.615	0.489
3 & 8alt	4.6	2.242	1.573	4.3	1.701	1.101	3.5	1.083	0.727	2.6	0.477	0.379
4 & 8alt	36.9	3.054	2.208	36.4	2.294	1.466	35.0	1.503	0.745	31.9	0.687	0.061
5 & 8alt	30.3	2.646	2.053	29.8	1.988	1.415	27.1	1.244	0.868	22.4	0.510	0.421
7 & 8alt	13.0	2.518	1.626	11.8	1.881	1.125	9.3	1.144	0.727	6.9	0.471	0.370

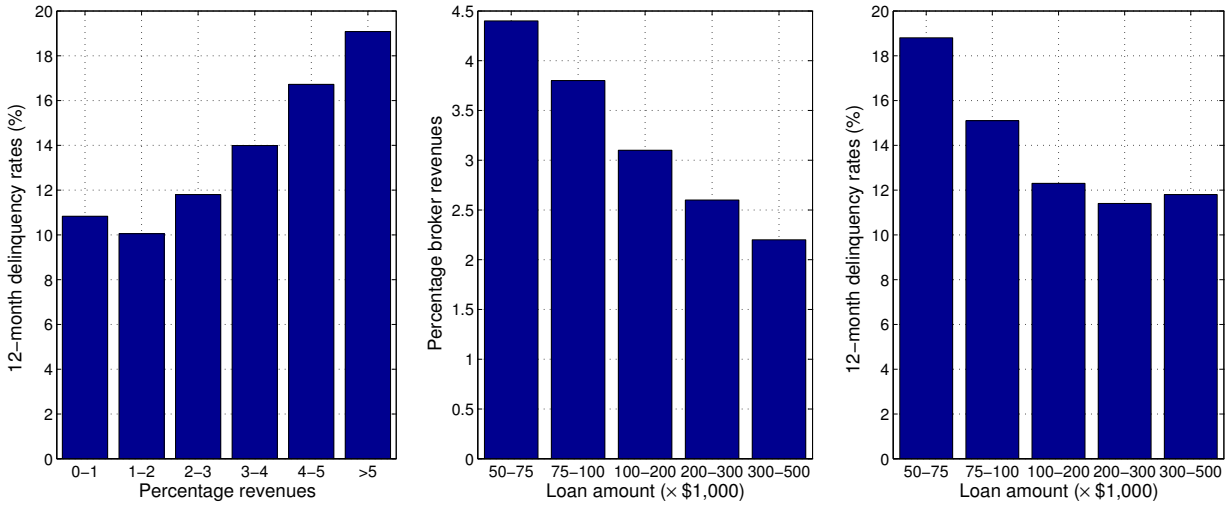

Figure 1: **Delinquency risk, loan size and percentage broker revenues** The left figure displays average 12-month delinquency rates as a function of percentage broker revenues. The middle and right figure show, respectively, average percentage revenues and 12-month delinquency rates for loans in different size bins.

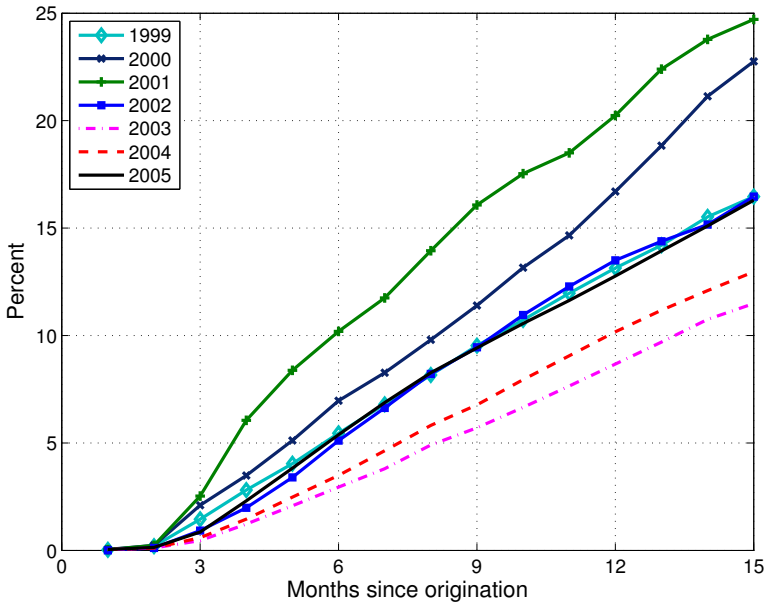

Figure 2: **Delinquency rates** The figure shows the fraction of loans delinquent as a function of months from origination, by year of origination. The delinquency rate is defined as the cumulative fraction of loans that were past due 60 or more days, in foreclosure, real-estate owned, or defaulted, at or before a given age.

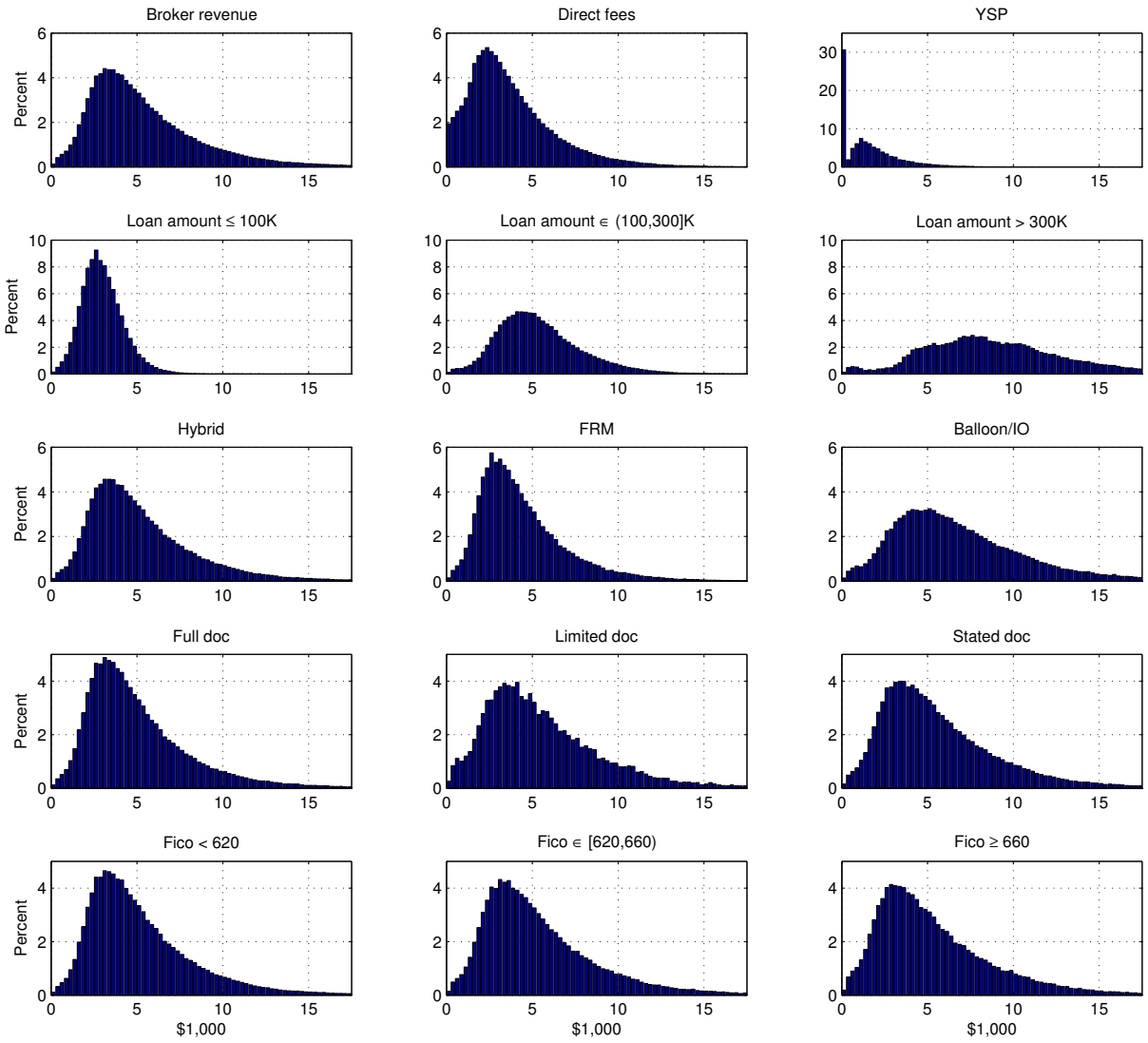

Figure 3: **Broker revenues, fees and YSP** The top panel shows the unconditional distribution of broker revenues, fees and yield spread premia. The next four panels plot the distribution of broker revenues across loan size, loan type, documentation level and the borrower's credit score.

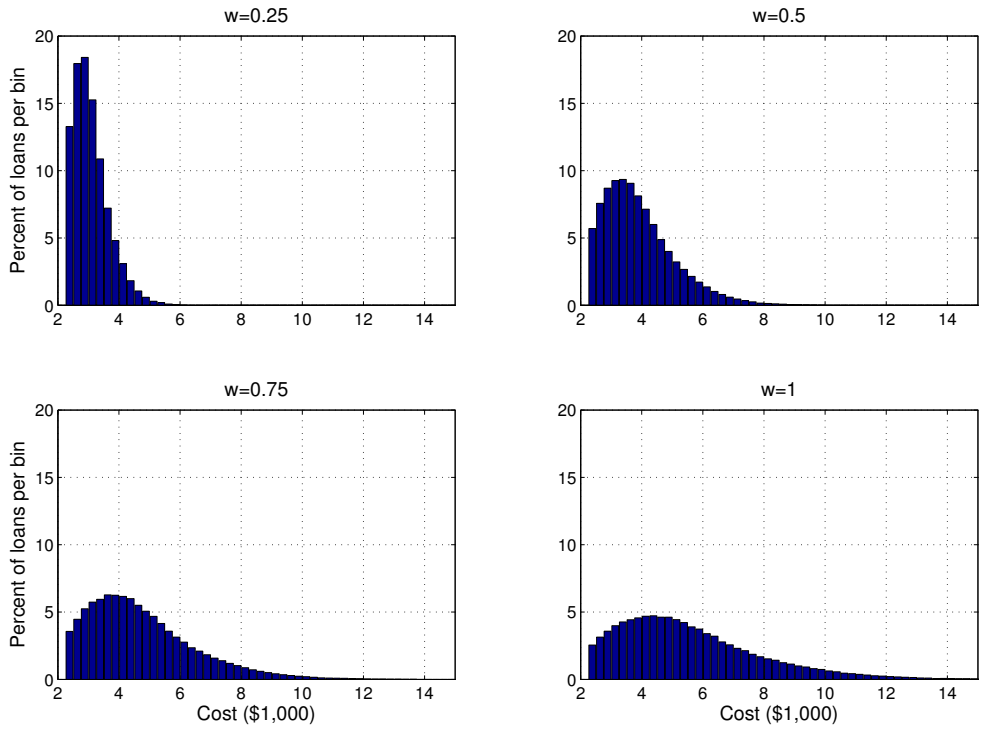

Figure 4: **Conditional cost distributions** The figures shows the empirical cost distribution, conditional on a loan amount between 100 and 300K, for different levels of w in Equation (11). Loans with revenues at or below the 5% quantile (2.3K) are not shown.

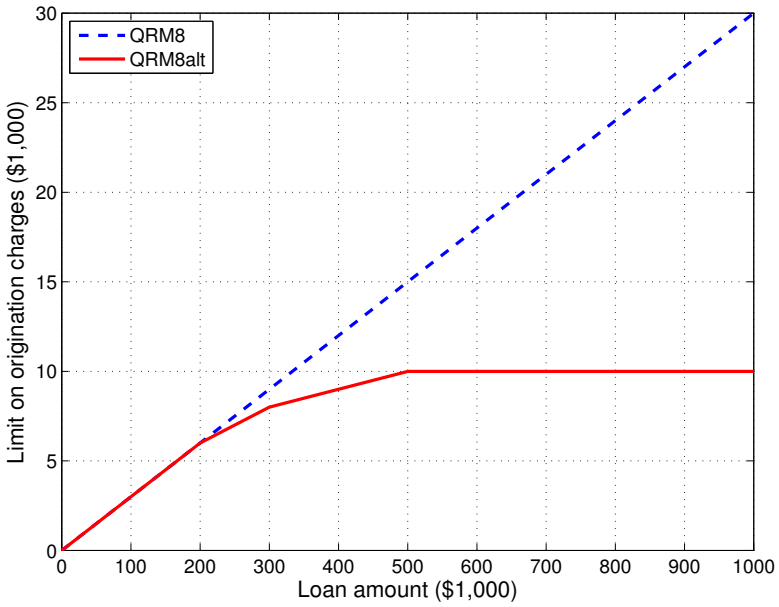

Figure 5: **Proposed and alternative QRM Rule 8** The Agencies (2011) proposed a cap of 3% on percentage origination charges. The alternative rule described in Section 8.3 restricts loan origination charges to 3% of the loan amount for loans of size 200K or less, and to 10K for loans of more than 500K. In between, maximum dollar charges grow according to a piecewise linear schedule, which caps origination charges at 8K and 9K for 300K and 400K loans.